THE

AMERICAN JOURNAL

OF THE MEDICAL SCIENCES.

NOVEMBER, 1898.

REMARKS ON RESECTION OF THE GASSERIAN GANGLION.[1]

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WITH A PATHOLOGICAL REPORT ON SEVEN GANGLIA REMOVED BY PROFESSOR KEEN.

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Up to the present time I have done eleven operations for the removal of the Gasserian ganglion. The first of these cases was reported in the *Transactions* of the Philadelphia County Medical Society for 1894 and in the *Medical and Surgical Reporter* for March, 1894, in conjunction with Dr. John K. Mitchell. It was the fourteenth operation done on the patient. From the date of that operation, October 18, 1893, the patient has been well. Although his condition of mental anxiety lest the pain should return, and his mental instability as a result of his long-continued use of opium, are very marked, yet practically he is well of his neuralgia. He still has pain, but not the old tic.

In The American Journal of the Medical Sciences for January, 1896, I reported five additional cases. The later history of these cases is as follows:

Case II.—The operation was done June 18, 1894. No ganglionic cells or nerve-fibres were found in the tissue supposed to have been removed from the site of the ganglion. The pain returned in six

[1] Read at the twenty-fourth annual meeting of the American Neurological Association, held in New York, May 26, 27, and 28, 1898.

This paper was written for the volumes published in celebration of Prof. Durante's completion of twenty-five years' surgical teaching in the University of Rome.

months, though not so badly as before. It still continues (September, 1897).

CASE III.—Died in a week from septic infection.

CASE IV.—The operation was done May 2, 1895, and at present September 29, 1897, she is entirely well.

Of Cases V. and VI. I append a brief summary, since the examination of the specimens from these two cases is an important part of the pathological report which follows.

Of the remaining five cases (VII. to XI., inclusive), which have never been reported, I give only a brief *résumé* of each, sufficient to compare with the pathological report. I shall publish them more fully hereafter.

In conjunction with my own remarks on the removal of the ganglion, and as a very important addition to our knowledge of the pathology of tic douloureux, I have been so fortunate as to secure the co-operation of my friend, Dr. William G. Spiller, who has examined with great care the seven specimens which I had removed and which were as yet unexamined. In all of these ganglionic tissue was found. These specimens cover the cases V. and VI. of my second paper and all the five additional cases (VII. to XI., inclusive) here briefly reported. I consider myself most fortunate in being able to enlist the services of so accomplished a neuro-pathologist as Dr. Spiller, and the value of his contribution will be seen not only in the text, but in the beautiful illustrations, for which we are indebted to the skill of Miss A. G. Newbold.

It will be observed that of the eleven, ten were secondary operations, multiple peripheral operations having been done in all the cases before the ganglion itself was attacked, with the exception of one case (Case VIII.). In this case, all of the branches being involved, I removed the ganglion at once. All of the operations were done by the Hartley-Krause method. Of the eleven three died, one from direct and avoidable infection (Case III.), the other two of shock.

In six cases (VI. to XI.) an attempt was made to remove the entire ganglion, and the illustrations from photographs show that I was perfectly successful in Cases VI. and XI. in removing the entire ganglion with its roots, and reasonably successful in removing at least the ganglion itself in all the others. In Case VI., in which the entire ganglion, including its second and third divisions, and its sensory and motor roots were removed, Dr. Spiller was able to obtain sections which showed the microscopical condition of the ganglion as well as its physical relations with its sensory root and peripheral branches all in a single slide. As the motor root joins the third branch on the distal side of the ganglion, it could not, of course, be cut in the same plane as the other portion of the ganglion. In Case VIII. we were fortunate also to have a ganglion from a case in which no peripheral operation whatever had been done.

One disadvantage Dr. Spiller has labored under is that I was not aware at the time of my operations of the technical value of Nissl's method, or I should not have preserved the entire specimens in Müller's fluid, which prevents their examination by that method. The cellular changes, therefore, could not be studied in all their details, but the advantages of the selected method of hardening for an examination of the alterations in the intra-ganglionic nerve fibres are very great. The next specimen I have Dr. Spiller shall have perfectly fresh, and be able to examine it by the Nissl method.

CASE I. *Breaking up of the Gasserian ganglion after thirteen prior operations; done in two stages, on account of packing to arrest the hemorrhage; recovery; cure for four and a half years.*—Dr. K., aged forty-one years. He had suffered from neuralgia for thirteen years, and had had thirteen operations done, including removal of a large part of the upper jaw, as well as various branches of the nerves. Date of operation, October 18, 1893. The anterior branch of the middle meningeal passed through a canal and was, of course, torn in turning down the flap. In chiselling the posterior portion of the flap the posterior branch was also divided and the dura wounded. Both vessels were secured after much

FIG. 1.

The dark portion indicates the area of imperfect sensation.

trouble. The hemorrhage, on lifting the middle lobe, was so great that the cavity was packed, and the operation completed in a second stage after three days, the ganglion being broken up. The piece of gauze was found to measure thirty-seven by six inches, or two hundred and twenty-two square inches. This remained in the skull for three days, during which time his temperature had risen to 100.8°, and the respiration had gone down to from six to ten in a minute, with a slight aphasia. Immediate recovery followed the completion of the operation. He has suffered from temporary twinges of the pain, but except these he has been free from pain. His general health has never been very

good. This patient was examined in September, 1897, by Dr. Spiller, whose notes are appended.

"Dr. K. states that he has real pain at times below the right eye and on the side of the nose, but has no paroxysms.

"Sensation is imperfect in the area indicated (Fig. 1), but evidently not entirely lost. He perceives pressure on the right side of the tongue, but no pain from the stick of a pin. Sensation on the inside of the right cheek is much impaired, but not destroyed. Tactile sensation is preserved on the back of the right side of the tongue and on the soft palate.

"He cannot taste salt, vinegar, or quinine on the right side of the tongue, even at the tip.

"The right masseter muscle contracts well, and the lower jaw is moved from side to side (pterygoid muscles).

"On account of the continuance of some form of pain, the absence of total anæsthesia, the preservation of the motor root of the fifth nerve, as indicated by the contraction of the muscles of mastication, and the probably intact or nearly intact condition of the first and third branches, it is evident that only a small portion of the ganglion was destroyed."

CASE II. *Breaking up of the Gasserian ganglion; done in two stages, on account of hemorrhage, after eight prior operations; recovery; recurrence of attacks.*—C. H. B., aged about thirty-five years. Neuralgia began in April, 1886, apparently from the filling of a tooth. From 1889 to 1890 subcutaneous neurotomy was twice done, the antrum drilled, the right infra-orbital resected three times, and the right carotid was tied. The last five operations were done by Dr. John B. Roberts. In March, 1890, the sight of his right eye began to fail, and in February, 1891, another surgeon removed the crystalline lens. When first seen in June, 1894, the right eyeball was utterly useless, the face was shrunken over the antrum, and for three years he had never been free from pain.

Operation, June 18, 1894. The middle meningeal ran in a groove and was torn in turning down the flap; secured by ligature. On lifting the temporo-sphenoidal lobe, the hemorrhage was so profuse that the wound was packed with gauze, measuring sixteen by six inches (ninety-six square inches). Cultures at the first operation and when the gauze was removed were sterile. The second and third divisions were torn loose from the ganglion, and the ganglion itself broken up. Dr. Burr reported that neither nerve fibres nor nerve cells were found in the supposed tissue of the ganglion. In September, 1897, the patient wrote that he had frequent sharp attacks of pain.

CASE III. *Breaking up of the Gasserian ganglion after two prior operations; rupture of middle meningeal at the foramen spinosum; infection after operation; death from septic meningitis.*—Mrs. E. E. H., aged sixty-three years. Neuralgia began in 1883. In 1889 inferior dental removed by Dr. Thomas G. Morton. On February 23, 1892, I removed the inferior dental nerve, which had been reproduced, and the lingual nerve by trephining the vertical ramus of the jaw. Recurrence of pain in November, 1893. At no point was there complete anæsthesia on the left side of the face; but, on the contrary, a large part of the skin was hyperæsthetic.

Operation, February 20, 1895. The anterior branch of the middle meningeal ran in a canal and was ruptured. While lifting the temporo-sphenoidal lobe the middle meningeal ruptured at the foramen spinosum;

arrested hemorrhage by packing with gauze. During the operation a gentleman, not one of my regular assistants, without my knowledge, infected an instrument which was used in the wound. She died at the end of a week. Pyogenic cocci were found by culture.

CASE IV. *Breaking up of the Gasserian ganglion after five prior operations; done in two stages, on account of hemorrhage; recovery; cure for three years; necrosis of bone in the flap.*—Mrs. S. R., aged sixty years. Neuralgia in the second and third divisions of the right fifth, for which five operations had been done, the last being a division of both of the branches at the foramina rotundum et ovale.

Operation, May 23, 1895. Rupture of anterior branch of middle meningeal, which ran in a long canal in the bone. On lifting the temporo-sphenoidal lobe, the hemorrhage was so severe and continuous that I packed a piece of gauze, afterward found to be twenty-three by fourteen inches (three hundred and twenty-two square inches), into the wound. Three days later packing removed and ganglion broken up. Dr. Kyle reported undoubted ganglion cells in the tissue removed. The central portion of the section showed slight, if any, variation from the normal, but the outer portion showed some inflammatory infiltration. Sections of the nerves showed a thickened neurilemma (inflammatory), with infiltration of round and spindle cells. No apparent change in the axis cylinders or white substance.

At the present time (May, 1898) she is still free from pain and her general condition good. Some of the bone in the flap necrosed.

CASE V. *Curetting of the ganglion after two prior operations; rupture of the middle meningeal at the foramen spinosum; post-operative corneal ulcer; recovery; cure for two years and a half.*—Mrs. F., aged fifty-four years, was first seen July 15, 1891. Neuralgia, at first confined to the right inferior dental, had existed for twelve years following an abscess at the root of a tooth. In 1886 a half inch of the right inferior dental was removed, with relief of pain for eighteen months. It then returned in the superior maxillary division.

FIG. 2.

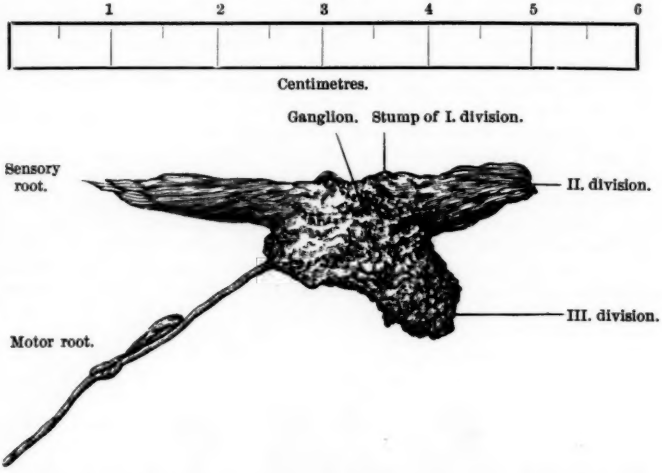
Gasserian ganglion (*a*) and second and third divisions (*b* and *c* respectively) from Case V.

July 17, 1891, I operated both on the inferior dental and the superior maxillary. The inferior dental was found reproduced and as large as the median nerve. This gave relief for over eighteen months. October 6, 1895, I operated on the ganglion. (Fig. 2.) In lifting the temporo-sphenoidal lobe the middle meningeal tore directly at the foramen spinosum. It was controlled by the Allis dissector, for which was substituted, first, the left forefinger, and then a small piece of iodoform gauze, which was packed into the canal. This iodoform gauze was removed on the third day. In a week the wound was entirely well.

On the third day after the operation a corneal ulcer developed. She went home November 27, 1895. The ulcer, which had been most skilfully treated by Dr. de Schweinitz, was then healing, and after very many vicissitudes, in the course of a year under the care of her physician, Dr. Moore, of Spartanburg, S. C., she recovered entirely. When last heard from, early in 1898, she was entirely well.

Case VI. *Removal of entire Gasserian ganglion, with its second and third divisions and both its sensory and motor roots back to the pons in a piece four centimetres long, after four prior operations; recovery; complete cessation of pain for two years and a half; post-operative corneal ulcer.*—C. W. E., aged thirty-three years, was first seen November 16, 1895. Neuralgia began five years before, after an attack of diphtheria. In March, 1895, the right upper teeth and the right alveolar process were removed. Since then three other operations have been done, including the removal of the infra-orbital nerve and opening of the antrum.

Fig. 3.



Gasserian ganglion, with the II. and III. divisions and the sensory and motor roots removed from Case VI. The nerve bundles are well shown. The motor root is elongated by the accidental reversal of one of its bundles. (From a photograph which unintentionally was enlarged about one-third, but the scale of centimetres which was photographed with the specimen will serve for comparison.)

Operation, November 22, 1895. The eyelids were first stitched together. On lifting the temporo-sphenoidal lobe the middle meningeal tore just above the foramen spinosum. It was secured with a ligature. The ganglion was twisted out complete, as is seen in the drawing. (Fig. 3.) A profuse hemorrhage occurred as the ganglion was removed, which I judged to be from the cavernous sinus. It was arrested by packing a strip of gauze, ten by one and one-half inches. After an uncomfortable night, the next day he had severe frontal headache, and his temperature had risen to 104°. Though the gauze had only been in for

twenty-four hours, I deemed it necessary to remove it, and no hemorrhage followed. The wound was entirely healed on the eighth day. Four days after the operation the stitches were taken out of the lids, but within twenty-four hours signs of corneal ulceration began. The lids were then stitched together again. After a great deal of difficulty Dr. de Schweinitz, who cared for his eye, was able to save it, but with only partial vision.

This patient was examined by Dr. Spiller, October 5, 1897, and his notes are appended.

"C. W. E. states that he has not had the slightest pain since the ganglion was removed; he has not even once had any indication of a return of the suffering. With the exception of a 'drawing sensation,' he has had no paræsthesia in the affected area. He has had no trouble with fish-bones and cherry-stones remaining in his mouth. When he masticates he uses only the muscles of mastication on the left side. The hair grows as well on the top of the head, in the eyelashes, moustache, and beard on the right side as on the left, and he has to shave the beard on the right side as often as on the left. The skin also is normal. These are interesting statements in view of the supposed trophic functions of the fifth nerve.

FIG. 4.

The dark shading indicates the area of complete anæsthesia for all forms of sensation; the light shading indicates the area of hypæsthesia.

"*Sensation.* Complete anæsthesia exists on the right side of the face in the area indicated in the drawing. This area shades off into the region of normal sensation, as is also indicated in the drawing. (Fig. 4.) The total anæsthesia extends to the median line of the face, but the hypæsthesia extends a slight distance beyond the median line into the left side of the face. The right nostril is completely anæsthetic. The inside of the mouth and the right side of the tongue, including the point, are anæsthetic on the right side. The back of the tongue and the soft palate, as well as the left side of the tongue, are sensitive. The right cornea, conjunctiva, and auditory canal are anæsthetic.

"The sensation of the face was tested for heat, cold, pain, and touch. On the left side of the face sensation is normal.

"*Taste.* He has no sense of taste for vinegar, sugar, or salt on the right side of the tongue, even at the point, but all these substances are tasted at the back of the right side of the tongue and still better on the left side of the tongue.

"*Motion.* There is no contraction whatever in the masseter and temporal muscles of the right side of the face, while on the left side the contractions seem to be unusually vigorous. The muscles of mastication on the right side are entirely atrophied. Saliva at times drops from the right side of the mouth.

"*Ocular condition.* He has some sight in the right eye; he can count the fingers held before him, and says he sees them sharply, but that most objects have a hazy outline. He cannot read with the right eye. The left eye is good. The conjunctiva of the right eye is much injected, and the cornea is slightly hazy as compared with the left. The eyelashes of the right lower lid grow inward and irritate the eyeball, and he has had most of them pulled."

CASE VII. *Removal of the Gasserian ganglion after two prior operations, with portions of its roots; recovery; cure for two years and five months, and no return as yet of the severe pain, but some paræsthesia.*—Mr. J. McM., aged seventy-six years, was first seen with Dr. Charles A. Currie, December 28, 1895. A tall and vigorous man, apparently much younger than his age; arteries free from atheroma. Twenty years ago, without apparent cause, neuralgia began in the second division of the right fifth nerve. Nine years ago the late Dr. Agnew resected the infra-orbital nerve, and, as the pain returned shortly afterward, three years ago Dr. Thomas G. Morton again resected the same nerve. Soon after the second operation the pain again returned, and has extended to all the branches of the fifth, coming in paroxysms only a minute or two apart and extending over the forehead, cheek, and jaw, the point of severest pain being a little in front of and below the ear and in the tongue. He is scarcely able to speak. Meat is only eaten when finely cut up, and even then causes severe pain. The anterior wall of the antrum is gone.

Operation, December 31, 1895. One-half grain of morphine and one-twentieth of strychnine were given before the operation, and the latter was repeated twice during the operation. As in all the other operations, ether was used, the operation lasting two hours. An osteoplastic flap was turned down and the anterior branch of the middle meningeal, which was torn in doing so, secured. When I had turned down the flap I found that the dura was so firmly adherent to the bone that the outer layer of the dura had adhered to the bone over a considerable extent and left the brain covered only by the thin inner layer. At one point the dura was ossified over an area of one-half inch. Other small areas of ossification were also found under the temporo-sphenoidal lobe. The third division was at least one-half inch away from the middle meningeal, and was quite small, less in cross section than the second. In isolating the third division considerable hemorrhage took place, though no vessel was seen; it was arrested by pressure. The ganglion was then seized and, after dividing the second and third divisions, was twisted out, the roots being imperfectly removed. The third division tore and had to be removed separately. I particularly noted whether

avulsion of the ganglion caused any shock. Dr. Spencer, one of my assistants, held his finger on the pulse at the moment, and no perceptible effect was produced either upon the pulse or in any other way that could be noticed. The eyelids had been stitched together before the operation. In ten days he went home, his highest temperature having been 100°. Since then he has remained entirely free from pain.

For the histological examination of the specimens, see Dr. Spiller's notes of Case VII. Dr. Spiller's notes of the patient's condition are added.

"At the present time, May, 1898, his general health is excellent, he has gained twenty-five pounds, has no return of the tic douloureux, but has some obscure "creeping" feeling in his right face. His eye waters somewhat, but otherwise there is no trouble.

"Mr. McM. stated that when he ate cherries or fish the stones or bones, as the case might be, collected on the right side between the teeth and cheek, and were not noticed until two or three hours later, when they were moved to some more sensitive area of the mouth.

"He has never had a return of the old severe pain, but has had 'three or four different kinds of pain' on the right side of the face. At times he has a sense of itching, which begins at the right ala nasi, and is followed by a sensation as of worms creeping over the anæsthetic area. This seems to be in reality a form of paræsthesia and not of pain.

FIG. 5.

The dark shading indicates the area of total anæsthesia.

"The area of total anæsthesia is indicated by Fig. 5, and, by comparison with Fig. 490 (*Gray's Anatomy*, p. 731, edition of 1887, edited by Keen), is found to correspond quite closely to the distribution of the second branch of the fifth nerve, leaving the distribution of the first branch intact and impinging slightly on that of the third. Along the border of the anæsthetic area a pin-point is felt as dull pressure. Within the area the anæsthesia is complete, except that pressure causes a displacement of the parts pressed upon, and affects the surrounding sensitive tissues, and is perceived in this way.

"No sensation is felt on the inside of the right cheek, and the right side of the tongue is almost anæsthetic, but not entirely so. Sensation at the back of the mouth on the right side is impaired.

"According to his statements, the saliva escapes at times from the right corner of the mouth, and at night the lower jaw hangs somewhat. He can open his mouth only to about the width of one and a half inches, and is obliged to cut his food into small pieces in order to get it into his mouth. In opening his mouth the lower jaw goes somewhat to the right, and this is probably due to more vigorous action of the external pterygoid muscle of the left side. No contraction of the right masseter is felt, and none of the right temporal muscle.

"Salt and acid are tasted a little on the right side of the tongue and quite well at the point on the right side.

"No loss of vision has occurred, but he complains of impairment of sight, which, most probably, is a result of old age. No trophic lesions of the eye are noticed. As the first branch is probably not destroyed, judging from the distribution of the anæsthesia, trophic lesions of the eye could hardly be expected."

CASE VIII. *Removal of the Gasserian ganglion as a primary operation; possible tear of the cavernous sinus, controlled by packing; uneventful recovery; cure for one year and eight months.*—Mrs. A. W. S., aged sixty-nine years, first consulted me January 11, 1895. Her present trouble began eighteen years ago, with pain in the left face. In a few years all her teeth were removed. The pain is chiefly felt in the second and third divisions, but is also felt in the area supplied by the first division. Free purgation by sulphate of magnesium and later by castor oil was tried for ten days without result.

FIG. 6.

Gasserian ganglion, from Case VIII.

Operation, January 24, 1896. The usual Hartley-Krause flap was turned down. The anterior branch of the middle meningeal ran in a complete canal, the posterior in excessively deep grooves practically equivalent to canals. All of these branches were torn, therefore, in turning down the flap, but were rapidly secured. The ganglion was seized, the second and third divisions severed, and the ganglion twisted out. (Fig. 6.) In doing so the second division tore loose from the ganglion, and was lost in the rush of blood which followed its avulsion. The hemorrhage was so severe that I was inclined to think that the cavernous sinus was torn, though this was uncertain. Packing by gauze controlled it readily. The highest temperature, on the third day, was 100.6° F. The gauze was removed on this day without hemorrhage. For three days the eyelids were closed by a bit of sterilized cotton and a bandage and by the Buller shield afterward. I kept her under observation for three weeks, lest trouble should ensue with the cornea, but when she went home the cornea was perfectly normal. She has

had no return of pain for a year and eight months. For report on specimen, see Case VIII. of Dr. Spiller's notes.

CASE IX. *Removal of the Gasserian ganglion after one prior operation; wound of cerebral vessels while making flap; rupture of the cavernous sinus, packing with gauze; coma and hemorrhage, followed by death in three days.*—Mr. G. K., aged forty-nine years; father and mother died of old age. In his personal history the only thing of importance is that he had smallpox at sixteen years of age. Seventeen years ago the pain began in the right upper jaw near the canine tooth, gradually extending over the cheek. A number of his teeth were extracted, without relief. Seven years ago, at the Jefferson Hospital, the infra-orbital nerve was removed, giving relief for two and a half years on the cheek, but the pain in the forehead still remained. His pain has become entirely unbearable. It extends over the right forehead and sweeps down to the cheek. The lower jaw is not involved. When he is quiet a touch on the cheek does not cause pain, but the slightest touch on the forehead is followed by intense pain. For the last six or eight weeks the pain has been increasing greatly in severity.

Operation, April 21, 1896. The Hartley-Krause osteoplastic flap was made by means of Dr. Cryer's drill. In making the first small trephine opening, in spite of the utmost care, the trephine slipped inside the skull. This was followed by copious hemorrhage, showing that a large vessel had been divided. The flap was then quickly turned down. As soon as the dura was exposed an extensive clot was found

FIG. 7.

Gasserian ganglion, Case IX.

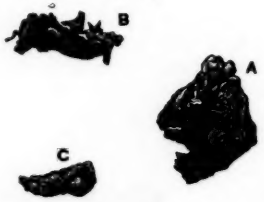
under it, having resulted from the mishap in the first small trephine opening. About an ounce of clot was removed; the source of the bleeding was a branch of the middle cerebral. The dura was then closed. The anterior branch of the middle meningeal ran through a canal and had been torn. This was ligated. The temporo-sphenoidal lobe was then lifted, the second and third divisions readily found, and the middle meningeal avoided. The ganglion was seized with a pair of hæmostatic forceps, the second and third divisions were separated, and I then attempted to twist out the ganglion. (Fig. 7.) In this I found two difficulties: one that the forceps did not grasp the ganglion with sufficient tightness to twist it, and the other that the third division had been only partly divided. The third division was then completely divided, and I removed the major part of the ganglion. A portion of the ganglion still escaped the jaws of the forceps. They were reapplied so as to get a good hold on the ganglion, but the moment that I began to twist it out a copious gush of venous blood convinced me that I had probably pushed the forceps too far inward and torn a rent in the cavernous sinus. The wound was packed with iodoform gauze immediately and the wound closed, leaving the packing in place. He reacted well; at the end of an hour his temperature was 97.4° F., but he was not yet conscious, and his puffing respiration made me suspect that the pressure of the gauze had produced what I hoped to be a temporary

hemiplegia. He remained, however, hemiplegic and unconscious till his death, at 1.20 A.M., on April 24th, almost three days after the operation. The temperature rose very little till about forty-eight hours after the operation, when it fluctuated between 103° and 104° F. The gauze (two hundred and sixty-seven square inches) was removed after forty-eight hours, without hemorrhage.

Post-mortem examination was refused. For the histological examination of the specimen, see Dr. Spiller's report of Case IX.

CASE X. *Removal of the Gasserian ganglion; death from shock in ten hours.*—Mrs. M. S., aged sixty-three years, first consulted me about the middle of October, 1896. She had suffered with neuralgia for over thirty years. A few years ago Dr. W. J. Hearn removed the second and third divisions, with relief for a considerable time. The pain has now returned not only in these two divisions, but also in the first. Unfortunately, the notes of the earlier history were lost by one of my assistants, and these are the only facts which I can give. (Fig. 8.)

FIG. 8.



Gasserian ganglion (A) and second and third divisions (B and C) respectively, from Case X.

Operation, October 31, 1896. The ordinary osteoplastic flap was turned down. The anterior branch of the middle meningeal divided into three large branches, all running in very deep grooves in the bones, and all were lacerated in turning down the flap. After some little trouble they were secured. The second and third divisions were readily found and traced back to the ganglion. In uncovering the ganglion I met with such profuse hemorrhage that I divided the second and third divisions and endeavored to remove the ganglion by traction instead of seizing the ganglion itself. I decided upon this procedure not so much because of the amount of blood lost, which constantly recurred upon the slightest manipulation in the effort to uncover the ganglion, as because of the amount of time lost. Avulsion of the third division brought a considerable quantity of the ganglion with it. When the second was avulsed no ganglion tissue could be recognized. The ganglion was broken up and wiped away by the small sponges which we used to check the hemorrhage. The operation lasted an hour and a half; the patient's pulse kept up very well, but the respiration was very poor. During the operation three doses of one-twentieth of a grain of strychnine and one one-hundredth of a grain of atropine were administered. In one hour after the operation she seemed to be reacting very nicely. Soon after that, however, she began to fail, and died ten hours after the operation. No post-mortem examination could

be obtained. For a full report of the specimen in this case, see Dr. Spiller's notes of Case X.

Case XI. *Removal of the Gasserian ganglion after six prior operations; recovery; cure for sixteen months; eyesight lost from secondary corneal ulcer caused by his neglect.*—F. W. P., aged fifty-six years. Neuralgia began six years ago in the right lower jaw. At different times he has had six peripheral operations by Dr. Parmenter, of Buffalo. He has operated on the inferior dental both in the dental canal and finally at the foramen ovale. On November 8, 1895, Dr. Parmenter operated on the Gasserian ganglion, but the pain returned within a month. When I first saw him the conjunctiva and cornea had normal sensibility, as also the skin of the entire face and the tongue.

Operation, January 22, 1897. Owing to the former Hartley-Krause operation, great difficulty was found in turning down the flap on account of adhesions to the dura mater. The anterior branch of the middle meningeal was ligated, as it had been torn during the removal of the flap. Temporary packing and heat were applied, which checked the hemorrhage very readily. The third and, later, the second divisions

Fig. 9.

Gasserian ganglion and second and third divisions, from Case XI. The ganglion is the mass to the right; the left portion is the second division, and the detached mass is the third division.

were then readily found, and later the ganglion laid bare. (Fig. 9.) It was seized with a pair of hæmostatic forceps, and the second and third divisions of the nerve severed at their foramina. The foramen ovale, instead of being oval, was distinctly triangular, and the nerve only partly filled it. The foramen was much larger than I had ever seen it before. The second division tore loose from the ganglion. Removal of the ganglion was followed by moderate hemorrhage. The operation was unusually long, two and a quarter hours, on account of the adhesions to the bone and also the difficulty of determining when I had reached the dura. The eyelids were stitched together at the close of the operation. Thirteen days after the operation he went home, his highest temperature having been 100° F. The stitches were removed on the third day and the eye covered by a Buller shield. When he went home the eye was in good condition and he was beginning to dispense with the shield. Later, through his negligence in covering the eye with a handkerchief without the shield, friction on the cornea produced a corneal ulcer, from which I learned later that he ultimately lost his eyesight. He has been now entirely free from pain for sixteen months. His gen-

eral health is excellent. For a fuller report of the specimen in this case, see Dr. Spiller's notes of Case XI.

To sum up the results of Dr. Spiller's researches, we may say that in a general way the pathological changes which he has found are:

1. That the medullary substance of the nerve fibres within the ganglion and its branches is much swollen, atrophied, or entirely gone, depending on the intensity of the disease.

2. That the axis cylinders similarly are markedly degenerated or entirely destroyed.

3. That the cells of the ganglion itself, in at least one case, are so degenerated or atrophied that there would be even doubts whether we were dealing with ganglionic tissue in certain parts of the field, were it not for the occasional nerve cells seen.

4. That the vessels are very distinctly sclerotic. In some instances the lumen is even entirely obliterated.

5. There is, in at least one case, a decided amount of increase in the connective tissue of the ganglion, which is enough to call the alteration a distinct sclerosis.

I propose now to consider four points:

1. Should the Gasserian ganglion be removed?

2. The answer being in the affirmative, to what extent shall it be removed—*i. e.*, shall we remove the entire ganglion, or only its outer two-thirds? or shall we be satisfied with simply "breaking it up" by blunt instruments or a curette?

3. Should the ganglion be removed as a primary operation, or should its removal be reserved till the very last operation for tic douloureux?

4. A few points in the technique.

1. The removal of the Gasserian ganglion is in some respects rather peculiarly American. The first deliberate proposal to remove the Gasserian ganglion was made by Dr. J. Ewing Mears, of Philadelphia (*Transactions American Medical Association*, 1884, vol. ii. p. 469). Andrews, of Chicago (*Chicago Medical Record*, 1891, vol. i. p. 322), had been at work for eighteen months devising practically the same operation as Rose, but the latter preceded him both in publication and performance (*Lancet*, 1890, vol. ii. p. 914). Similarly, Hartley, of New York, and Krause, of Altoona, almost at the same time devised the method of operating which has been most used and is, on the whole, perhaps the best method.

Of the 108 cases of intracranial operations on the fifth nerve, collected by Tiffany (*Transactions American Surgical Association*, 1896, vol. xiv. p. 1, and *Annals of Surgery*, 1896, vol. xxiv. p. 575), seventy-nine were done by American surgeons and twenty-nine by European surgeons.

Whether we ought still to resect the ganglion depends, in my opinion,

on three conditions: (*a*) The mortality of the operation; (*b*) its efficiency as a means of permanent cure; and (*c*) whether its disadvantages, especially the possibility of the loss of the eye on the operated side, can be avoided.

(*a*) The mortality of the operation may be taken as that shown by Tiffany's table (108 cases, twenty-four deaths), a mortality of 22.2 per cent. For an operation done by modern antiseptic or aseptic methods, a mortality of over one-fifth is very large. I have no doubt it will be diminished in the future, as we learn by experience to deal with the vicissitudes and emergencies. In fact, surgically speaking, we *must* master and overcome so large a mortality. No one who has ever resected a Gasserian ganglion will speak lightly of the operation. Even now, after having operated on eleven, I always approach the operation with a certain amount of hesitation. The mortality alone would cause me to answer the third question positively in favor of the resection being reserved for the last of the series of operations instead of the first.

(*b*) What has been the history of the cases as to cure? So far as I know, there have been four cases in which the pain has returned; one of Rose's, one reported by Dana, and two by myself. But I especially desire to call attention to the fact that my own two cases of recurring pain were my *first two operations;* that in Case I. no microscopical examination of the fragment removed was made, and in Case II. the examination revealed no ganglionic cells or nerve fibres. As I now look at it, Case I. was imperfectly done, and Case II. still more so. Therefore the recurrence of pain in these two cases cannot be used as an argument against the removal of the ganglion. The facts as to recurrence of pain in these two cases have been given earlier in this paper.

In addition to this, Krause has reported one case in which the sensory root was found diseased, and the pain returned on the other side of the face. We can conclude, therefore, in general, as a result of experience in over one hundred cases of intracranial operation on the fifth nerve that, practically, the pain will return in not over 1 or 2 per cent. with any such severity as to liken it to the original disease, and that it will return to any degree in not more than 4 or 5 per cent. Perhaps, if we consider the uncertainty of total excision of the ganglion in the reported cases in which pain did return, this percentage is too high. As Dr. Spiller has shown, there are only two cases known to him in which the sensory root has been examined (although it may be that Krause examined the sensory root in some of his other cases); one of these was by Krause and one by himself. In Krause's case the root was diseased, and the pain returned upon the opposite side. In my own case (Case VI.), though the lesions of the ganglion were very intense, and the disease had existed for five years,

yet Dr. Spiller found the sensory root entirely free in longitudinal as well as transverse sections. We must expect, as a result of both the clinical history and the pathological examination of Krause's case, that the disease may not only reach, but may pass beyond, the ganglion to the sensory root, and that, therefore, even the removal of the ganglion will not always absolutely prevent a return.

(*c*) Apart from the mortality the chief danger is the loss of vision, if not of the eyeball. This, I think, I now know how to master. I shall consider it under the question of technique. All other disadvantages, such as the possible necrosis of a piece of the bone, the sinking in of the flap, or the possible uselessness in a certain number of cases of the muscles of deglutition, are very slight as compared with the immense relief from the horrible pain. My conclusion, therefore, is that the removal of the Gasserian ganglion should still be done, but that we should especially strive to lessen the mortality of the operation.

2. To what extent shall the ganglion be removed? Tiffany has expressed the opinion (1) that the motor root can be saved, and (2) that it ought to be saved. In some of my cases, though I have made no attempt to save the motor root, the muscles of mastication on the operated side were not wholly paralzyed. In Case VI., in which the motor root was certainly removed, the muscles of mastication on the operated side are atrophied and useless, but the patient can readily masticate meats, the lower jaw being easily moved by the muscles of the opposite side. I do not, however, believe that the motor root can be preserved. In the first place, I do not think that, from an operative point of view, it is possible to do so, and, secondly, the very careful dissection of the ganglion made by Jouvara (Chipault's *Travaux Neurol. Chir.*, 1897, vol. ii. p. 205) makes me sure that this is even anatomically quite impossible. He says (pp. 209-210), "the masticatory nerve [by which I take it he means the motor root] and its branches are very adherent to the trunk of the inferior maxillary division and are contained in the same sheath of connective tissue; the separation of these two nerves is difficult even by the most careful dissection, and to avulse the inferior maxillary without at the same time avulsing the masticatory nerve is veritably impossible." If this cannot be done on the dead body by the most careful dissection, it cannot be done on the living during the exigencies of an operation.

In the microscopical examination of Case VI. the motor root was found to form an intimate part of the third branch so near the ganglion that it would have been very difficult or even impossible to separate it from the ganglion at the time of operation. Another point is worthy of mention; the peripheral sensory branches must degenerate after resection of the ganglion, and it may be that in the sclerosis which follows the destruction of the sensory fibres in the third branch the

motor fibres would be at least partly affected even if they had not been cut. The only possible absolute necessity for preserving the nerve would be the need for preserving it in case of a bilateral resection of the Gasserian ganglion. This has never yet been necessary, and will surely be extremely rare. If, after destruction of the ganglion, the muscles of mastication on the sound side are sufficient for the purposes of mastication, I see no reason to trouble ourselves to preserve the motor root.

A much more important question as to the extent of the removal of the ganglion is whether the entire ganglion shall be avulsed, such, for example, as is seen in Fig. 3 from Case VI. of my own series and in several of Krause's photographs (*Neuralgie des Trigeminus*), or whether we should follow the recommendation of Tiffany, that only the outer two-thirds of the ganglion, together with the second and third divisions, should be removed and the inner third left. The only object in leaving the inner third is the conservation of vision. But, as shown below, I believe that our methods of dealing with the eye are so improved that we can positively now remove the ganglion and yet conserve the eye.

In addition to this we must remember that the ganglion is not divided into thirds physically or physiologically. It is not true that the inner third of the ganglion is connected exclusively with the first division and supplies the eye, the middle third with the second division, and the outer third with the third division; but the cells of the ganglion in every part are more or less connected, so far as we know, with any or all of the three divisions.

An arbitrary line, therefore, removing the outer two-thirds and leaving the inner third will leave undoubtedly diseased ganglionic cells if the ganglion is affected. If these cells are diseased, any stimulus from the first division will excite sensation in them, and thus may bring about a return of the pain.

As the only objection to removing the whole ganglion—the effect upon the eye—can now, I think, be overcome, we ought, I believe, distinctly to aim at the removal of the entire ganglion.

3. Shall the ganglion be removed as a primary operation—the very first after the disease has set in—or shall it be left till the last operation?—that is to say, shall we perform as many peripheral operations as can be done first, and only remove the ganglion when we are driven to it?

I believe that this last is the proper position to take.

While Dr. Spiller, from his investigations of the pathology, is not able to say positively whether the ganglion becomes diseased primarily or secondarily, yet, as he points out, the clinical evidence would lead us to believe that the ganglion is the last of all to suffer. Of course, after any peripheral operation, just as after an amputation of an arm, atrophic changes will set in which will go direct to the Gasserian ganglion, and may, so far as we know, reach to the pons, or even possibly

the cortex, just as after an amputation of an arm atrophic changes can be traced into the central nervous system, yet these are very different from anything like an ascending neuritis which would involve the ganglion in inflammatory troubles as a result of the preceding disease of the nerve branches.

The effect on the ganglion, even after eighteen years of suffering, in Case VIII., was very slight. This, so far as I know, is the only examination of a ganglion in which no peripheral operation had been done, and in which the examination is, therefore, free from any suspicions of alteration in the ganglion other than that due to a possible ascending neuritis. It must be stated, however, that the entire ganglion could not be examined microscopically. If the ganglion is not diseased, therefore, primarily I believe that we ought to attack the disease where we know it exists—namely, in the peripheral branches. If the ganglion is primarily diseased, we cannot understand how it is that relief is afforded for one, two, three, or more years by a peripheral operation. The simple shock of the operation would not keep a diseased ganglion quiescent for months or years. My own conviction, based on examinations so far made, is that the disease, in many cases at least, is primarily peripheral and that the ganglion is involved by extension upward. In those cases in which some local growth is found on the branches of the fifth nerve the cause of the pain must, of course, be peripheral, and we have no means of detecting the presence of such a lesion previous to operation. I would, therefore, urge not only that the removal of the Gasserian ganglion should be the *last operation*, but I would specially urge that peripheral operations be done *early*. Most operations for tic douloureux are made two, three, five, ten, or even twenty years after the disease began and after vain attempts have been made to cure by drugs. My own view decidedly is that, if the disease has positively existed for so long a period as three or four months, and if during this time, while drugs may have relieved, they have not *cured* it, I would *wait no longer, but instantly do the peripheral operation in the hope of arresting the peripheral disease and preventing its upward course, which in time will result in its involving the ganglion.*

When we remember the fact that all the peripheral operations are virtually without danger to life, and that they relieve for a considerable time, and that we are in a position now to state that the mortality of Gasserian operations is over 20 per cent., and that in a small percentage of cases even the removal of the Gasserian ganglion *may* not surely and permanently cure, I think we are in a position to say that the removal of the ganglion should not be done till we have exhausted our resources in peripheral operations, or till a larger surgical experience shows that the removal of the entire ganglion will cure permanently and a better surgical technique greatly lessens the present mortality.

4. A few points in technique:

(*a*) *Access to the cranial cavity.* There is no question in my mind that either the Hartley-Krause operation, or the operation of Doyen (which I have never yet attempted), or an operation somewhat analogous to it, described by Poirier in Chipault's *Travaux de Neurologie Chirurgicale*, 1897, vol. ii. p. 213, is the preferable one. All of these approach the ganglion from the side and by lifting the temporo-sphenoidal lobe. By no possibility can one work with the same advantage either as to light or facility of manipulation by Rose's method. Whether the flap shall be raised by chisel or drill or saw I think is a matter largely of preference of each individual operator.

(*b*) *Hemorrhage.* In three instances I have done the operation in two stages on account of hemorrhage, packing iodoform gauze into the skull in these cases. The amount of gauze which I have used has surprised me very much. In one case it was 37 by 6 inches, or 222 square inches of gauze; in a second, 23 by 14 inches, or 322 square inches; in a third, 267 square inches; and in a fourth a piece 16 by 6, or 96 square inches. I mention this to show what an amount of pressure the brain will stand, but I also mention it to condemn the procedure if it is possible to avoid it. The danger of infection is always considerable in any case in which the skull cavity has to be reopened. Moreover, I think we ought always to avoid testing the power of the brain to stand pressure, if we can. I join, therefore, heartily with Krause in urging that the operation shall be completed in a single sitting, if possible.

Hemorrhage from the middle meningeal has almost invariably taken place in all of my operations, either by unavoidable tearing of the vessel in turning down the flap, or, as happened three times, by the tearing of the vessel at the foramen spinosum. In the latter case the simple use of the Allis blunt dissector, to block up the vessel for a moment by the curved end, and later the substitution first of the left forefinger and then of a small bit of iodoform gauze, will overcome the difficulty, if the vessel cannot be ligated. On no account, in my opinion, should the external carotid be ligated as a preliminary measure. In one case in this city (Philadelphia) in which it was done, necrosis of the temporal flap took place, and the patient's death from sepsis followed as a result.

(*c*) *The removal of the ganglion itself* is best done by Krause's method —namely, uncovering the ganglion and then seizing it and twisting it out after dividing the second and third divisions at their foramina. This method of removal should be employed instead of the uncertain method of "breaking up" the ganglion when we act blindly and unscientifically.

(*d*) *The preservation of the eye.* The method which experience has taught me now definitely to adopt is as follows: Either immediately

before or at the close of the operation I disinfect the eye and sew the two lids together by two or three stitches, near the margins, drawing together only the middle of the lids. This leaves the two ends open sufficiently, first, for washing the space between the lids and the eyeball with a warm boric-acid solution, to wash away any mucus, and also leaves enough space for us to observe the cornea when the patient looks strongly to one side. This occlusion of the lids should last for not less than four or five days. The stitches may then be cut and the eye immediately covered by a Buller shield—*i. e.*, a watch-glass held in place by means of either a circular fenestrated disk of rubber plaster or by four separate pieces of plaster. I prefer the circular plaster.

The reason for the corneal ulceration and loss of vision or loss of the eye is undoubtedly, first, the drying of the cornea, due to the want of appreciation of its drying and, therefore, to want of winking, by which the cornea is kept moist; and, secondly, as another result of the want of sensitiveness of the cornea, either foreign bodies get into the eye, or, as in one of my cases, a bandage over the eye may rub the cornea and thus produce ulceration and the destruction of the cornea. The use of the Buller shield is so thoroughly satisfactory both in protecting the eye and in keeping it moist that I think any one who has tried it will be unwilling to dispense with it afterward. Its use should be continued for from ten to thirty days after the operation.

Pathological Report, by Dr. Spiller.

(From the Wistar Institute of Anatomy and Biology.)

Little attention has been paid to the microscopical examination of the Gasserian ganglia removed from patients suffering from tic douloureux; indeed, with the exception of a few cases, we have had almost no information furnished us on the pathological condition of these structures in the disease. It was, therefore, with a feeling of deepest interest that I undertook the examination of the ganglia removed by Dr. Keen from seven cases of prosopalgia.

This report is based on a study of several hundred sections. The stains employed have been carmine, hæmatoxylin (Delafield's and Weigert's), osmic acid (methods of Azoulay and of Marchi), thionin, acid fuchsin, and eosin. The method of Rosin has given most satisfactory results for a study of the nerve fibres, and in some cases, in which the material did not stain readily with carmine, Delafield's hæmatoxylin, with an after-stain of acid fuchsin, presented beautifully colored specimens. Unfortunately, the method of Nissl could not be employed, as all the ganglia had been placed in Müller's fluid. The method of Azoulay proved to be of great service, for in some cases in

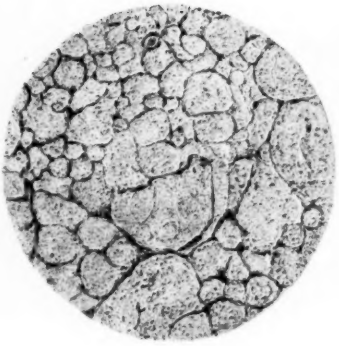


FIG. 11.

FIG. 10.

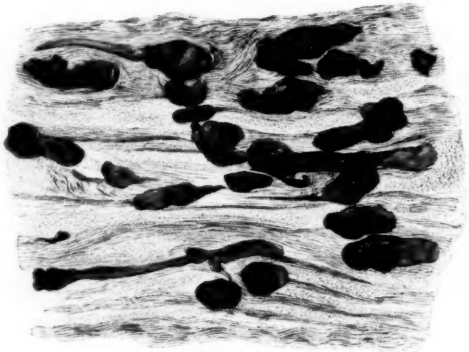


FIG. 12.

FIG. 13.

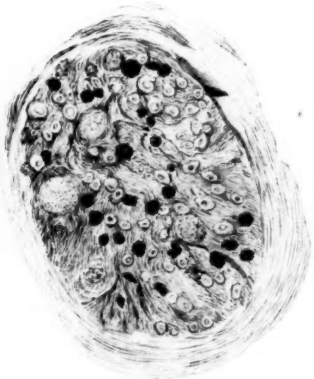


FIG. 14.

which the method of Weigert did not give thoroughly satisfactory results, the former yielded sections well stained.

Case V.—The nerve fibres are greatly altered; in many the medullary sheaths are much swollen, and no traces of axis cylinders can be seen; in others the latter are represented by irregular and separate masses of a hyaline-like red substance, which have little resemblance to normal axis cylinders. Many nerve sheaths are entirely empty. The vessels are sclerotic, and some of the smaller ones are entirely closed. The ganglion cells are in different stages of degeneration; some are faintly stained and have very indistinct outlines, and there are numerous spaces in which the cells have entirely disappeared. Some of the nerve cells are very small and without nuclei and nucleoli, though possibly this may be due to the fact that superficial portions of these cells were obtained in the sections, and the connective tissue between them is increased in amount. The pericellular spaces seem to be somewhat larger than in normal ganglia, and appear as if the cells had shrunken away from their capsules. No very great difference can be noticed in the condition of the second and third branches of the nerve, for they seem to be nearly equally diseased.

Case VI.—The ganglion removed from Case VI. presents, on microscopical examination, most distinct evidences of degeneration. The medullary sheaths of many of the intraganglionic fibres are greatly swollen, and the fibres have an irregular, beaded appearance in longitudinal sections. (Fig. 10.) Some bundles, cut transversely, contain masses of medullary substance varying greatly in size and of most irregular form, and without a trace of axis cylinders. Stained by the method of Azoulay or Weigert, these masses of medullary substance stand out prominently, and it is noticed that frequently they are not continuous with one another, but that they are connected by empty and contracted nerve sheaths. There is no great increase in the number of the nuclei of the sheaths of Schwann. Normal bundles of fibres are found lying close to fibres very greatly degenerated. It is impossible to find any greater alteration of the fibres belonging to the second than of those belonging to the third branch of the trifacial nerve.

Description of Plates.

Fig. 10. Portion of the Gasserian ganglion at the entrance of the third branch of the trifacial nerve, from Case VI. The medullary sheaths are most irregularly swollen, and at the right of the field empty nerve sheaths are seen (method of Azoulay).

Fig. 11. Portion of the second branch of the trigeminal nerve near the Gasserian ganglion, from Case VI. The axis cylinders have entirely disappeared, and the medullary sheaths are greatly swollen. In many places the medullary substance of two or more nerve fibres has united into irregularly shaped masses.

Fig. 12. One of the nerve bundles within the Gasserian ganglion, from Case VI. Numerous swollen and irregularly formed axis cylinders may be seen. In most portions of the field these appear as drops of a red, hyaline-like substance, but in one portion an axis cylinder of considerable length may be seen.

Fig. 13. Bloodvessels from the Gasserian ganglion in Case IX. The walls are greatly thickened, and the lumen of the large vessel has been almost entirely obliterated. In one place the innermost layers of the vessel have contracted from the outer during the process of hardening. Smaller vessels in the upper part of the field are entirely closed.

Fig. 14. A nerve bundle of the trigeminus close to the Gasserian ganglion, from Case X. Only a few nerve fibres are present, and everywhere an abundance of connective tissue is seen. Three much swollen medullary sheaths are in the field.

The sensory and motor roots are normal; the nerve fibres in these roots present medullary sheaths which stain well and have normal outlines. Longitudinal and transverse sections of the motor and sensory roots, and of the second and third branches of the nerve, have been obtained; the first branch had been broken off close to the ganglion at the time of the operation.

Transverse sections of the motor and sensory roots present the usual number of nerve fibres, each with an axis cylinder surrounded by a medullary sheath and separated from the other by a moderate amount of connective tissue. The contrast afforded by the transverse sections of the second and third branches with those of the sensory and motor roots is most striking. In the second branch, especially, the irregular and large masses of medullary substance are very distinct (Fig. 11), and in many bundles it is impossible to detect axis cylinders. Atrophied fibres seem to predominate in the transverse sections of the third branch, though in longitudinal sections a little nearer the ganglion the swollen medullary sheaths are as visible as in the second branch. The ganglion was cut longitudinally in such a manner that its relation to the second and third branches and the sensory root are shown in a single section. In some intraganglionic nerve bundles axis cylinders may be found greatly swollen and occurring in irregular masses of a pinkish hue when the carmine is employed as stain, but these masses are more numerous in certain bundles. (Fig. 12.) The process has evidently reached a stage in which the swollen axis cylinders have in large part been removed. The connective tissue about and between the bundles of nerve fibres is not very excessive, but is increased to some extent between the individual fibres.

The ganglion cells are somewhat more irregular in outline, the smaller cells are more numerous, and the pericellular spaces are larger than in normal ganglia. Many cells contain vacuoles, but the nuclei are not eccentric and the nucleolus can usually be seen. The pigmentation of the cells is not excessive, and the capsules of the cells do not appear to be much thickened, nor are their nuclei unusually numerous. The intercellular tissue is not notably increased. In some places the cells are very small and faintly stained, though a few appear unusually large and swollen, but these are comparatively rare. The most striking alteration of the cells is the atrophy with the enlargement of the pericellular spaces, of which the latter may be due to changes which have occurred after removal of the ganglion.

The small vessels in many parts of the ganglion are greatly altered; some are completely closed by the proliferation of the tissue in the walls of the vessels, while others show only a slight alteration.

Case VII.—The ganglion cells are most irregular in shape, and appear to be somewhat more separated than normally from one another by overgrowth of the intercellular connective tissue. Some of the cells are not sharply defined from the surrounding tissue, and some do not contain distinct nuclei or nucleoli. In some places the ganglion cells have been destroyed and removed; in others the cells contain much pigment and some vacuoles. The cellular changes are greater than in the preceding case, in which they are not especially striking. The medullary sheaths of the nerve fibres in many places are greatly swollen. Many nerve bundles contain very small nerve fibres; many are entirely deprived of nerve fibres and contain merely connective tissue; and

many contain swollen medullary sheaths without axis cylinders. The small vessels have thickened walls, and some are entirely closed by proliferated tissue.

Case VIII.—Some of the vessels are sclerotic, but there is little change in the nerve fibres. The smaller ganglion cells are abnormally abundant. In some places the medullary sheaths are somewhat swollen.

Case IX.—The findings in this case consist of swollen medullary sheaths, diseased axis cylinders, proliferated connective tissue in the nerve bundles, with destruction of nerve fibres, and altered ganglion cells. Only a portion of the ganglion has been obtained, but it is sufficient for the purposes of microscopical study. The cells and their capsules in certain parts can be distinguished with difficulty from the surrounding tissue; in other parts they are much more distinct; it is frequently impossible to detect nuclei or nucleoli, and one might well doubt whether he were examining ganglionic tissue were it not for the fact that here and there a nerve cell is detected. The intercellular tissue has replaced the ganglion cells.

The bloodvessels are much altered, as may be seen in Fig. 13. In the vessel represented here the media and intima are much thickened, and the latter has almost entirely filled the lumen of the vessel, leaving several smaller passages for the current of blood. In the process of hardening the inner coats at one portion have contracted and withdrawn from the outer, leaving an open space.

Case X.—The medullary sheaths in certain parts of the sections are greatly swollen, and the axis cylinders have been almost entirely destroyed (Fig. 14) and removed, leaving small lumps of pinkish hyaline substance here and there. Many nerve sheaths may be found in which the medullary substance and axis cylinders have entirely disappeared. The vessels seem to be less affected than in the other cases in which evidences of intense degeneration have been noted. The ganglion cells have indistinct outlines, and some stain very faintly. The intercellular tissue is increased in amount, and throughout the sections in which the ganglion cells are found numerous granular corpuscles are noticed.

Case XI.—The ganglion cells are vacuolated, but do not appear to be greatly altered, nor are the cell capsules notably thickened. In one portion of certain sections nerve bundles are found in a high degree of degeneration; the medullary sheaths have almost entirely disappeared, leaving only granular masses here and there; the axis cylinders are swollen, and the connective tissue and empty nerve sheaths occupy a large portion of the fields. The vessels are somewhat altered.

In six of the cases just described the lesions are of an intense degree and unquestionable. In a seventh case (Case VIII.) they are much less distinct.

The lesions in the Gasserian ganglion in the more advanced cases of tic douloureux consist of much-swollen medullary sheaths, swollen axis cylinders, atrophied fibres, empty nerve sheaths, nerve bundles in which the nerve elements have been destroyed and only connective tissue is left, atrophied ganglion cells, cells faintly stained, and sclerosed blood-

vessels, in some cases even without a lumen. In all the specimens examined numerous red blood-corpuscles are observed, which doubtless owe their position within the tissues to the surgical interference.

The pathology of tic douloureux has not been well known. Some have held that it is a neurosis; others that it is a neuralgia, though this distinction is not very clear; and still others that it is a neuritis. Some have believed that the disease is a peripheral one, and others that the primary lesion is within the ganglion. There is always a possibility that in some cases the lesion may be a central one.

Putnam[1] says that, as a rule, neuritis is present in trifacial neuralgia, and probably exists far oftener than we think. This seems to me exceedingly probable, for the dividing line between neuralgia and neuritis cannot be sharply drawn. One, we are told, is a functional, the other an organic process; but "functional" is a very comprehensive term. Putnam states that of late years physicians have been more favorable to the view that, in chronic forms of neuralgia, at least, the pain is simply the expression of the inflammation of a nerve.

Dana[2] placed much more value on the condition of the bloodvessels than on inflammatory changes in the nerve fibres.

In a recent communication to the writer he expresses the opinion that trifacial neuralgia is due to degenerative neuritis of the peripheral sensory neurons of the fifth nerve, depending on or associated with obliterating arteritis.

The investigations by Thoma[3] of the bloodvessels from the painful area in supra-orbital neuralgia, and his explanation for their sclerotic condition, are most interesting.

Rose[4] also has remarked on the size of the vessels and the thickness of their walls in some of the cases on which he operated. He found great alteration of the peripheral nerves in trifacial neuralgia. The appearances were those of chronic neuritis, and were often more marked at the peripheral than at the central end of the nerves.

Microscopical alterations of the peripheral branches of the fifth nerve in cases of tic douloureux have also been noticed by Tuffier,[5] De Schweinitz,[6] Horsley,[7] Tripier,[8] Putnam,[9] Krause,[10] Spiller,[11] and

[1] Putnam: Boston Medical and Surgical Journal, 1891, vol. ii. pp. 157, 186.
[2] Dana: Medical News, May 16, 1891.
[3] Thoma: Deutsches Archiv für klinische Medicin, 1888, vol. lxiii. p. 409.
[4] Rose: Transactions of the Medical Society of London, 1892, vol. xv. p. 157.
[5] Tuffier: La France médicale, 1881, vol. i. p. 672.
[6] De Schweinitz: In paper by Mears, Transactions of the American Surgical Association, 1885, vol. ii. p. 469.
[7] Horsley. Transactions Odontological Society, 1887, vol. xix. p. 270. Cited by Rose.
[8] Tripier: Revue de Chirurgie, 1889, vol. ix. p. 453.
[9] Putnam: Boston Medical and Surgical Journal, 1892, vol. ii. pp 157, 186.
[10] Krause: Die Neuralgie des Trigeminus Leipzig, 1896.
[11] Spiller: Journal of Nervous and Mental Disease, June, 1898, p. 400. (In a paper by J K. Mitchell.)

others, and macroscopical changes have been detected by Tuffier,[1] Mears,[2] Tripier,[3] Keen,[4] and others.

Krause's[5] book is the most thorough which has as yet appeared on trifacial neuralgia. Though he found alterations in branches of the fifth nerve which had been slowly twisted out, he was unable to detect changes in the vessels. Krause observed marked lesions in the Gasserian ganglion in cases of tic douloureux, but only in one case could he demonstrate changes in the sensory fifth root, and in this case after the pain had disappeared on one side of the face, as a result of excision of the ganglion, it recurred on the other.

Krause could not find the sclerosis of the ganglion which other writers describe, and which certainly exists in one of Dr. Keen's cases (Case IX.).

In six of Krause's seven cases resection of the nerves had preceded by some years the excision of the ganglion, and he justly compares his findings with those seen after amputation, but he regards them as too intense to be merely secondary. He thinks the question cannot be positively settled until a ganglion is examined the peripheral nerves of which have never been resected. This examination has been made in Case VIII. of this paper. In none of Krause's cases did the neuralgia return after excision of the ganglion, even within three and a half years after the operation, and as the peripheral operations did not give permanent relief, and extirpation of the ganglion did do so, he thinks it is allowable to conclude that the cause is to be sought in the Gasserian ganglion.

It seems to me quite possible that the trouble may first be peripheral, and as resection gives only temporary relief, the recurrence of the pain may be due to extension of the morbid process to the ganglion.

Krause is disposed to regard the changes in the ganglion partly as primary and partly as secondary from the resection.

The fact that nerve degeneration may extend beyond the spinal ganglia and affect the posterior roots must make us prepared for the possibility of an extension of a similar process after extirpation of the Gasserian ganglion.

Other investigators who have found lesions of the Gasserian ganglion are Wedl, Rose, Podrazky and Lavéran, Horsley, Putnam, and Antonino d'Antona (all cited by Krause).

The possibility of the changes in the ganglion being secondary, as Krause suggests, is not to be lightly passed over. Lugaro[6] has shown

[1] Tuffier: La France médicale, 1881, vol. i. p. 672.
[2] Mears: Transactions of the American Surgical Association, 1885, vol. ii. p. 469.
[3] Tripier. Revue de Chirurgie, 1889, vol. ix. p. 453.
[4] Keen: THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, 1896, vol. i.
[5] Krause: Die Neuralgie des Trigeminus. Leipzig, 1896.
[6] Lugaro: Rivista di Patologia nervosa e mentale, 1896. Cited by Schaffer in Monatsschrift für Psychiatrie und Neurologie, July, 1897.

that the nerve cells of the spinal ganglia undergo marked alteration after lesions of the peripheral fibres, and the spinal ganglia are so similar to the Gasserian that the results of these experiments may be applied to the latter.

Fleming has noticed that the cells of the ganglia on the posterior nerve roots in rabbits and dogs undergo definite changes as the result of nerve section or of ligature, and do so at a much earlier period than do the multipolar cells in the cord, beginning probably as early as the fourth day, and certainly by the seventh day. The nucleus, and sometimes the nucleolus also, become small, and the nucleus may be excentric and even bulge the cell wall. The chromophilic granules are altered, the cells atrophy, and the pericellular lymph spaces become enlarged. Just here we may mention, however, that Lanhossék's[1] recent studies on fresh spinal ganglia, obtained from an executed man, have taught us that when the ganglia are properly hardened such pericellular lymph spaces do not exist. Fleming[2] also says that large vacuoles are found in some cells. He thinks it is quite comprehensible that the cells of the ganglia should suffer before the cells of the anterior horns, inasmuch as nerve impulses pass normally to them from the site of the lesion.

Kowalewsky[3] cut the sciatic nerve in animals, and injected a few drops of a 5 per cent. chromic acid solution into the central end. The animals were killed two to four days later, and the chromophilic bodies of the cells of the spinal ganglia were found much altered.

If, therefore, such alterations of the ganglion cells occur within a few days after resection of the nerve we may expect greater changes when the time which has elapsed since the operation is reckoned by years instead of days. And yet it is probable that some of the lesions of the ganglion cells which have been described are only of a temporary character.

Neuritis may ascend; it seems that the possibility of this, though often disputed, must be acknowledged. Mlle. de Majewska[4] has recently written a thesis on the subject. She states that the lesions of ascending neuritis are the same as those of ordinary peripheral neuritis; viz., fragmentation of the myelin, multiplication of the nuclei, and alteration of the axis cylinders. There is no reason why this neuritis should not extend to the cells of the Gasserian ganglion.

It is well, of course, to examine an entire Gasserian ganglion in a case in which resection had never been performed, but the examination of the motor root in a case in which the third branch of the fifth nerve

[1] Lanhossék: Archiv für Psychiatrie, vol. xxix. No. 2.
[2] Fleming: Brain, parts lxxvii. and lxxviii.
[3] Kowalewsky: Abstract in Monatsschrift für Psychiatrie und Neurologie, vol. ii. No. 2, p. 147.
[4] Mlle. de Majewska: Abstract in Revue Neurologique, 1897, No. 15.

had been resected in the portion which contains this root, would also be of value, if done some years after the operation. Should no degeneration of the motor root be found there would be some evidence that the ascending degeneration had not been important, for this ascending degeneration is not limited to sensory fibres.

Krause could demonstrate changes in the sensory fifth root only in one case. In Case VI., which I have examined, the sensory root is perfectly normal. The cells of the Gasserian ganglion have each a single axis cylinder, which, at a short distance from the cell body, divides, and one branch passes centrally and the other peripherally. If, therefore, the lesion is primarily within the ganglion cells, we cannot understand why only the peripheral branches of the axis cylinders are diseased, while the central branches remain normal. The same objection has been raised against the ganglionic theory for the commencement of tabes in the spinal ganglia, only in the latter case the central branches of the axis cylinders are diseased and the peripheral, as a rule, are intact.

The great and durable improvement occurring in many cases of trifacial neuralgia after removal of the Gasserian ganglion would seem to indicate that the cause of the suffering is to be sought, at least in many cases, in the Gasserian ganglion; but it by no means follows that we may expect to find lesions of the ganglion in every case, any more than we may hope to find lesions of the spinal ganglia in every case of tabes in which there has been pain, unless the employment of the method of Nissl changes our views, which Schaffer's[1] recent studies make improbable.

We know that a lesion within the cerebrum may produce intense pain, as Edinger,[2] Biernacki,[3] and Kirchhoff[4] have shown, and Gowers[5] states that in a case known to him irritation of the sensory nucleus of the fifth nerve in the pons seemed to be the cause of the suffering in the face. Indeed, Gowers says distinctly that we know nothing of the sensory function of the posterior ganglia, and are justified in looking to the nerve cells within the cerebro-spinal axis as the seat of the morbid process.

In a case of trifacial neuralgia, therefore, attention should be directed not only to the condition of the Gasserian ganglion, but also, if possible, to that of the sensory nucleus of the fifth nerve, and to the spinal root of this nerve—*i. e.*, the descending branch.

We must acknowledge, it seems to me, that pain is not the usual manifestation of a lesion confined to the brain or cord, and, indeed, the

[1] Schaffer: Neurologisches Centralblatt, 1893.
[2] Edinger: Deutsche Zeitschrift für Nervenheilkunde, 1891, vol. 1.
[3] Biernacki: Deutsche med. Wochenschrift, 1893, No. 52, p. 1372.
[4] Kirchhoff: Archiv für Psychiatrie, vol. xxix. No. 3.
[5] Gowers: A Manual of Diseases of the Nervous System, vol. ii. p. 803. English edition.

presence of pain in cases of suspected hæmatomyelia leads one to diagnosticate hæmatorrhachis. We do not, as a rule, find pain in chronic degenerative processes of the cord which respect the posterior roots and meninges, as, for instance, in syringomyelia, but we find it as an early symptom of tabes, which is also a chronic process, but one which affects the posterior roots.

As Gowers states, vascular dilatation attends functional activity, and it is probably also true that vascular dilatation, if not excessive and too prolonged, causes functional activity. Excessive functional activity of sensory cells may be manifested as pain, but it is possibly equally true that diminution or imperfect quality of the blood-supply may be a cause of pain. How can we better explain the frequent headache of anæmia? If, therefore, we find alteration of the bloodvessels within the ganglia, we may with reasonable suspicion look upon the condition, in part at least, as the cause of the pain, and may believe that peripheral irritation which under normal conditions would not be perceived would be sufficient to produce painful sensation.

As yet, as far as I am able to judge from my researches in the literature, the Gasserian ganglion excised from a case of trifacial neuralgia has never been examined by the method of Nissl.

This method is so important for a study of degenerative changes in nerve cells that no one can say that such changes are absent until he has used the method. Nissl[1] teaches that the employment of the older methods of technique, especially the hardening of the tissue in the chromic salts and the staining with carmine, are not only unsuitable, but likely to be most misleading, a view which most neuropathologists accept.

I am unable, therefore, from a study of these seven cases and from an examination of the literature, to state whether the lesions of the ganglia are primary or secondary, and, if secondary, whether of the nature of ascending neuritis or not. The possibility of the secondary nature of the process within the ganglia in some cases, it seems to me, should not be overlooked. I base the opinion of a possible peripheral involvement, in certain cases, chiefly on the clinical evidence afforded by the relief of pain during two or more years in some patients by nerve resection, though, unfortunately, such cases are in the minority; on the normal condition of the sensory root in Case VI., and on the examination of Case VIII. of this paper, in which the lesions are very slight in comparison with those in the other cases, though the pain had existed for eighteen years. It is true that only a part of the ganglion was obtained in this case, and it is possible that this portion was the least diseased, but it is remarkable that in all the other cases intense

[1] Nissl: Allgemeine Zeitschrift für Psychiatrie, vol. liv. Nos. 1 and 2, pp. 26-27.

alteration was found, and in some of these the parts of the ganglia obtained were not larger than in Case VIII.

Case VIII. is the only one of the seven in which a primary resection of the peripheral branches was not done. The pain involved all three branches of the fifth nerve, and Professor Keen therefore attacked the ganglion at once. The possibility of an ascending neuritis in this case, due to nerve resection, is excluded, inasmuch as no operation on the peripheral branches had been performed.

The clinical evidence is of importance, for an absence of pain for two or three years seems to indicate that during the respite the ganglion cannot be greatly diseased. No branch of the fifth nerve is sharply limited to any one portion of the Gasserian ganglion, and were the ganglion primarily diseased the resection of one branch would not remove the peripheral irritation transmitted by the other branches to the hypersensitive cells.

There can be no doubt that intense alteration of a chronic inflammatory character may be found in the Gasserian ganglion in certain cases of tic douloureux, and also that the sensory root may be intact. This, it seems to me, is a satisfactory explanation for the relief of pain experienced by many patients in whom the ganglia have been excised.

The removal of the diseased cells within the Gasserian ganglion, which are capable of responding abnormally to every peripheral irritation, may well be attended with the relief of pain. Excision of the ganglion destroys at once the paths of painful sensation from a large area.

The integrity of the sensory root, in the case in which the whole ganglion was removed by Professor Keen, is a fact of considerable importance. It teaches that though the ganglion may be greatly diseased, the process may be arrested at this point. In the other case in which the sensory root was examined—the only other case (Krause) with such an examination which seems to have been reported, though possibly Krause examined the sensory roots of some of the other ganglia, and if so, he probably found them normal—the fibres were found diseased, and the process extended to the other side of the face. This report, and the four cases (one reported by Rose, two by Keen, and one by Dana) in which the pain returned after removal of the ganglion, though we are not sure that all portions of the ganglia were excised in these cases, must make us prepared for the possibility of a renewal of the suffering in some instances, even after the excision of the Gasserian ganglion.

I feel more than ever inclined to believe, from a study of these cases, that neuralgia cannot be sharply distinguished from neuritis, and in some cases of so-called chronic neuralgia, such as obstinate sciatica, I believe we may frequently be able by the microscope to detect evidences of chronic inflammation. At the same time we should not forget that neuritis may assume different clinical forms.

If it could be shown that the sensory root of the Gasserian ganglion does not unite after its fibres are divided, we should have a fact of great importance. Division of this root would probably be a less serious operation than the removal of the entire ganglion, and might have the same effect in the relief of pain, but the surgical difficulties might be insurmountable. Experiments on animals to determine whether or not the sensory root of the Gasserian ganglion unites after section of its fibres might result in a lessening of the great mortality now existing in operations on the ganglion.

THE CAUSES AND CONDITIONS OF PULMONARY TUBERCULOSIS, AND HOW TO AVOID THEM.[1]

By Edward O. Otis, M.D.,
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That instinct which prompts us to regard all men mortal but ourselves has, doubtless, its salutary influence in that it conduces to a more placid endurance of the "chances and changes of this mortal life." On the other hand, however, it is likely to beget in us a carelessness in regard to many of the avoidable dangers to life, particularly when these dangers are ever present with us, breeding a dangerous contempt from our constant familiarity with them. It is always useful, and in season then, to cry "memento mori" with regard to any of the great and constantly present risks to human life, with the hope that we may become more keenly conscious of them, and incited to employ any and all precautions against them. Prevention is always more satisfactory than cure, and the attempt more inspiring. In it the physician exhibits the highest aim and ideal of his unselfish art. From a mercenary point of view, moreover, the cost of prevention is far below that of attempts at cure.

One and probably the greatest danger which threatens human life at the present time is pulmonary tuberculosis; either directly or indirectly it touches the life of almost every individual; one-half of the human race suffer from it, and its ravages are as wide as the habitable world. The mortality from it approaches that of smallpox a hundred years ago, causing from one-fifth to one-seventh of all the deaths—"more than smallpox, diphtheria, scarlatina, typhoid fever, typhus fever, yellow fever, cerebro-spinal fever, Asiatic cholera, relapsing fever, leprosy, measles, and whooping-cough combined."[2] Moreover,

[1] An essay to which was awarded the "Pray" prize for 1897 of the New Hampshire Medical Society for "the best original essay upon some medical topic."

[2] Bergy: "Bovine Tuberculosis," etc. Medical News, January 23, 1897.

its greatest number of victims is among the very young and those in the prime of life. Holsti[1] has shown that the mortality is greatest during the first two years of life; the least from the ages of five to fifteen; and then it rises steadily until between thirty-one and forty years. Those whom it does not destroy it incapacitates for labor. We know now that consumption is curable, but at the best only a comparatively small per cent. are cured or permanently arrested, and those generally in the incipient stages and under the most favorable hygienic and climatic conditions. That we shall ever be able to cure any large number of cases by antitubercle serum seems to me problematic, for when the disease is once thoroughly established the infection becomes a mixed one, and various other micro-organisms are brought into play, and the whole system becomes involved. How early in the disease this happens we know not; but often, I believe, before the patient or his physician suspects or has detected the original bacillary infection.

From every point of view, then, the most hopeful outlook in combating this disease is by prevention, and in order to work effectively in this direction one must be familiar with the causes and conditions which lead up to it. To produce a case of pulmonary tuberculosis two factors are always essential: the bacillus and a favorable soil. All of us, especially in the city, are repeatedly exposed, I doubt not, to the tubercle bacillus, and yet those only are infected who present favorable conditions for the development of the germ. On the other hand, no matter how susceptible the individual or how small the "resistance potential," how unfavorable the climate or hygienic conditions may be, if the specific micro-organism is absent, tuberculosis is impossible. Brehmer,[2] who wrote many years before Koch's discovery of the tubercle bacillus, gives an interesting account of the inhabitants of Iceland, among whom pulmonary tuberculosis did not then exist. These people, he says, lived under the most unfavorable and unhygienic conditions. The winter was long and dreary, the sky cloudy, and the atmosphere filled with dampness. Their dwellings were small, dirty, dark, and unventilated, each person having scarcely ninety-nine cubic feet of air to breathe. These abodes were filled with foul-smelling vapor, arising from the débris of fish lying about the door, and the smoke from dried dung which constituted their fuel. Their food consisted mainly of dried fish which had begun to putrefy, a preparation of milk, called "sky," large quantities of rancid butter, and sour whey mixed with water; they also drank large quantities of alcohol. Their occupation was one of exposure in fishing, bird hunting, and sheep- and cattle-herding. Their feet were constantly wet. In spite of this extraordinarily unwholesome and pernicious condition of existence, no case of pulmonary tuberculosis

[1] Annual of Universal Medical Sciences. Sajous, 1894.

[2] Die Chronische Lungenschwindsucht und Tuberculose der Lunge, 1869.

existed. In seeking an explanation for this absence, Brehmer suggests the ingenious theory of a physiological augmentation of the circulation, with the resulting increased metabolism, and, perhaps, increased development of body heat produced by the use of an enormous quantity of fat, daily use of whey, and the extreme physical exertion incident to their occupation. The true explanation, of course, was that the tubercle bacilli have never been carried there. Whenever any of the Icelanders migrated to the mainland of Denmark, phthisis was extraordinarily frequent among them, as one would expect, for then occurred the union of the favorable soil from Iceland with the bacillus existing in Denmark.

Dr. Frederick A. Cook,[1] who accompanied Lieutenant Peary's Arctic Expedition, says that the Esquimaux of South Greenland are subject to tuberculosis in great numbers; and he estimates that two-thirds of the inhabitants suffer from some form of this disease. In the Arctic highlands, however, where Peary wintered, no case of tuberculosis was found. Also, upon the shores of Northwest Greenland, Dr. Cook found a small tribe of Esquimaux completely isolated on all sides by the glaciers and through a superstitious belief that the interior was inhabited by men and animals of gigantic size, and among these people tuberculosis had never been observed. Probably similar hygienic and climatic conditions existed in both cases; but the bacillus had been carried to South Greenland and had not reached the other localities.

To prevent tuberculosis, then, we must lead our efforts in two directions, that of eliminating the bacillus and that of establishing an immunity from it by promoting a normal standard of health. That we shall ever succeed in exterminating the elusive and ubiquitous bacillus appears now to be a chimerical fancy; but proof is already at hand that its wanderings can be restrained and its baleful influence curtailed. Italy, by methods of prevention,[2] reduced the mortality from this disease in less than a century from that of a most virulent epidemic to a comparatively rare disease; and England, by establishing special hospitals for its treatment and the consequent isolation of its tuberculous poor, reduced its mortality 50 per cent. in forty years; Philadelphia has reduced the mortality about 20 per cent. in eight years; and in New York City it has been reduced more than 30 per cent. in twelve years.

The specific germ—the tubercle bacillus—comes from tuberculous individuals, from the milk of tuberculous cows, from the flesh of infected cattle, and, in rare cases, from other domestic animals. Chiefly, however, the source of the germ is from tuberculous man, and from the dried sputum. The bacillus gains entrance into the body through the

[1] Revue de la Tuberculose, 2, 1894, p. 376.

[2] Flick: "Practical Measures for the Prevention of Tuberculosis." The Medical Record, October 21, 1893.

mucous membrane of the respiratory and digestive tracts, and by the skin. By far the most common entrance is through the respiratory tract, the bacillus being held in suspension in the air and entering the lungs through respiration. Congenital tuberculosis—direct transmission from mother to child—is possible, but so rare that it can be disregarded. It may be possible, also, that the bacillus may be conveyed directly by the breath; but in most, if not all, of the cases in which this appears to take place, the true source is probably the dried sputum. Tubercle bacilli exist wherever consumption exists, and are constantly being added to through the carelessness, ignorance, and helplessness of the consumptive. They are found in the dust of our streets; consider the enormous amount of expectoration constantly going on there, a certain proportion of which is tuberculous. On one side of a city street I counted 193 expectorations in less than an eighth of a mile; in another locality where fewer people pass I counted 211 in rather more than that distance. They are in our workshops and factories; in stores, banks, halls, hotels, school-houses, churches, theatres, street and steam cars, steamboats, and innumerable private residences. Wherever people congregate there are sure to be some persons, who, suffering from pulmonary tuberculosis, expectorate upon the floor, down radiators, upon their handkerchiefs, and in various places where the sputum will dry and set free the infecting germ.

The bacillus thrives especially in dark, damp localities, overcrowded and ill-ventilated rooms and halls; in tenement-house districts, where the air spaces are small, sunlight scarce, and ventilation poor. The bacillus is a very wily germ, and secretes himself in dark nooks and crannies for almost an indefinite period, until some disturbance, like the removal of a dusty garment or a piece of furniture or hanging, or sweeping, floats him in the air, where he is ready to infect the first person who approaches his vicinity presenting a favorable soil.

In investigating the etiology of the disease it is a frequent experience, especially among the poor classes, to obtain a history of intimate contact, often extending over months, with some other consumptive. It may be as caretaker, room-mate, fellow-worker in shop or factory, or wife, husband, brother, sister, or friend. Or, if not in contact with the consumptive himself, we may find that our patient has occupied a room where a consumptive has lived or died, and disinfection has been neglected or imperfectly performed. In all such cases the presumption is strong that direct infection took place through the bacilli scattered by the previous consumptive or the one intimately associated with.

Dust in unclean localities, in the streets of cities, in tenement-houses, on the wares of the fruit-vender's booth, upon the garments of second-hand clothes dealers, on the plush-covered seats of cars or the bedding of a sleeping-car, on the furniture and hangings of a room occupied

by a consumptive, is always to be regarded as a possible source of tuberculosis. Says a writer,[1] "It would be difficult to conceive of a conjunction of circumstances more directly contributive to disseminate this disease, tuberculosis, than is offered in the palace-car." Let us take some illustrations of the foregoing statements: Prausnitz[2] inoculated guinea-pigs with scrapings obtained from railway coaches on the line from Berlin to Meran (a line much used by consumptives), and found that the scrapings from five coaches contained virulent tubercle bacilli. Petri[3] has also proved the presence of tubercle bacilli in the dust of railway wagons. Dr. Hance[4] examined the dust collected from street-cars, and proved the presence of tubercle bacilli by the inoculation of guinea-pigs. One in five cars examined was found dangerous to the health of the travelling public.

Schuirer,[5] on rinsing the dust from some grapes which had been lying in a room looking out upon a narrow street where consumptives congregated to attend a clinic, noticed that the water was quite dirty. Injecting ten cubic centimetres of it into the peritoneal cavity of three guinea-pigs he obtained the following results: One died of peritonitis in two days; the other two lived forty-five and forty-eight days respectively. Post-mortem examination revealed tuberculosis originating at the site of inoculation and involving the peritoneum, liver, and spleen, with small deposits in the lungs. Microscopical examination revealed numerous tubercle bacilli.

Kirchner[6] narrates the following fact: Three sergeants of a Prussian regiment employed in a portion of a warehouse containing clothing and military goods, successively contracted tuberculosis, from which all three died. Kirchner collected six specimens of the dust found upon the various articles of military clothing kept in the part of the warehouse where the sergeants were employed, and inoculated six rabbits with it, but with negative results. On repeating the test, however, with six more rabbits he obtained the following results: Three rabbits died of tuberculosis of the peritoneum in eighty-four, one hundred and one, and one hundred and eight days after the inoculation; two died of sepsis, and one remained alive, but his autopsy later showed no tuberculosis. He concludes from these experiments that the three soldiers contracted tuberculosis from the bacilliferous dust upon the clothing.

Of 311 animals inoculated with dust from rooms occupied by phthisical patients by Cornet,[7] 167 died soon after infection; 59—*i. e.*, one-

[1] Sajous' Annual, 1890.
[2] Quoted in Sajous' Annual of Universal Medical Sciences for 1892.
[3] Revue de la Tuberculose, ii. 1894.
[4] "A Further Study of Tubercular Dust," read at the New York Academy of Medicine, January 21, 1897.
[5] Sajous' Annual, 1892.
[6] Revue de la Tuberculose, 1896, No. 2, p. 142.
[7] Annual of Universal Medical Sciences. Sajous, 1889.

fifth of the whole number—were found tuberculous, and 85 were healthy. A room in a hotel occupied for six weeks by a phthisical actress, and a workshop occupied by a tailor who had directly communicated the disease to a fellow worker, were found infectious. But in no case was the dust of the walls infectious when sputum-cups were used exclusively to receive the expectorated matter. The same negative results were also obtained in the City of London Hospital for Diseases of the Chest, the Adirondack Cottage Sanitarium, and the Winyah, at Asheville, by Drs. Heron, Hance, and Von Ruck, proper disposal of the sputum being made in all of these institutions.

Kirchner[1] also has shown by a series of experiments that persons who are in good health can be with the tuberculous, as parents, attendants, etc., without fear of becoming infected by bacilliferous dust, provided that the sputum and dejections are carefully collected and removed, and the receptacles serving for this purpose are scrupulously disinfected.

Miller[2] gives the following instance: "A lady, with her five daughters, four of whom were most of the time at school, took up her residence in a house in which, six years previously, there had lived a gentleman who had died of pulmonary tuberculosis but a short time after removing from the house. For the next six years the house was occupied by an old lady who died, but not from pulmonary tuberculosis. Within a year of moving into the dwelling the mother became tuberculous and died at the end of three years. During her illness the eldest daughter displayed symptoms and signs of pulmonary tuberculosis, and left home for six weeks, returning apparently well, and remained well thereafter. A few months after the death of the mother the second daughter, who had not long been away from school, displayed similar symptoms; but she also recovered after leaving home. Several years later the third daughter, soon after leaving school, presented consolidation at the left apex and died within a short time. Stained cover-glass preparations made from the dust obtained from the dining-room of the house in which the unfortunate family lived disclosed the presence of tubercle bacilli in considerable numbers."

C. O. Maish[3] gives the following case: "A German, aged sixty-two years, weighing two hundred pounds, of good family and personal history, came to him in a state of advanced consumption. Two years before he had lost a son, aged twenty-three years, from the same disease. Three months later his wife, who had nursed the son, began to sicken. She was a German, aged fifty-nine years, strong, robust, and well preserved, weighing more than 220 pounds, with a good family history. She died within twenty months, having had frequent hemorrhages from the lungs and intestine and almost constant diarrhœa. Within five

[1] Revue de la Tuberculose, 1895, iii. p. 175. [2] British Medical Journal, January 13, 1894
[3] New York Medical Record, October 13, 1894, referred to in Sajous' Annual for 1896.

months the husband was in the condition just described; while a daughter, aged twenty-two years, worn out from constant attention to the sick, was in a fair way to become phthisical, if not already so. It was learned that all three had expectorated on the walls, floors, and in the corners of the apartment, the man preferring to expectorate under his bed. The daughter slept in the same room with the sick man, and slept beside her mother during her illness."

From the *Traité de Médecine*, Charcot, vol. iv. p. 595, I cite the following case: In a small and ill-ventilated portion of a counting-house containing twenty-two employés, there came two tuberculous persons, coughing and expectorating often upon the floor. The employés came early in the morning to work, when the air of the place was charged with dust from the daily sweeping. Thirteen of them died from phthisis from 1884 to 1889. The contagion occurred very probably through the air holding in suspension the bacilli from the dried sputum on the floor. The small and badly-ventilated portion of the counting-house was abandoned, the floor destroyed, and the whole thing removed, and prophylactic measures instituted. Three years elapsed since this was done, and not a single new case of tuberculosis had occurred.

In asylums, prisons, and various other institutions where large numbers of human beings are kept in close contact, pulmonary tuberculosis is frequently the most common disease among the inmates and sometimes produces an almost epidemic mortality. "There are," says a report from the Illinois State Prison,[1] "1400 convicts within the walls, and fully one-third of them have consumption in a light or bad form. Nearly all deaths of persons in the penitentiary have been caused by consumption, and, as a rule, all 'long termers' either die within the walls from the disease or are pardoned out on account of it."

Baer and Cornet found that from 45 to 75 per cent. of all deaths in penal institutions were due to tuberculosis.[2] In the last report of the Taunton (Mass.) Lunatic Hospital for the year ending September 30, 1896, the Superintendent, in his report, says: "Seventeen died of phthisis, which was a large number, although the percentage of deaths from this disease was not greater than in many previous years. Most of the cases developed in the old part of the hospital, where the breathing-space is less and the overcrowding more apparent."

In a community of 400 Apache Indians, taken from a free nomadic life in Arizona and New Mexico and transferred to Alabama, where for four years they occupied log cabins badly constructed and situated in a low, damp hollow, and in which filth gradually accumulated "until they became veritable incubators of disease," the deaths from tubercu-

[1] Quoted by J. G. Hopkins, M.D., Thomasville, Ga., in "Contagiousness of Consumption." Reprint from the Journal of the American Medical Association, 1893.

[2] Flick: Medical News, October 21, 1893.

losis in five years were seventy-eight, or 43½ per cent. of the total number of deaths.[1]

All this does not prove that the tubercle bacillus will infect every person brought within its influence, or, infecting them, will produce any injurious results; for in that case few of us would escape. The second factor must always co-operate, a favorable soil. The system must be in a receptive condition, which is generally, if not always, a depressed one; the "resistance potential" is low; and coincident with this there is often some defect in the respiratory passages or in the pulmonary tissue itself, which a bronchitis, pleurisy, influenza, or pneumonia may have caused. This matter of a favorable soil, however, will be discussed later.

Although, as I have said, the dried sputum is the principal source of the tubercle bacillus, there is also a very appreciable danger of contagion from food, especially from the milk and meat of diseased animals. This infection from food takes place principally through the alimentary canal, but it has also been found by Boullard[2] to occur through decayed teeth or an exposed cavity in the gum after a tooth has fallen out spontaneously or has been removed. An absorbing surface is presented affording lodgement for tubercle bacilli that may be contained in insufficiently cooked meat or other food. Starck,[3] in examining 113 children with cervical adenitis, found that 41 per cent. showed the presence of carious teeth, and almost always the enlarged gland corresponded to the seat of the carious tooth. He mentions two cases of tubercular adenitis, in one of which numerous tubercle bacilli were found in two carious teeth, and in the other tuberculous granulations at the bottom of a carious excavation were discovered. Cadeac, of Lyons,[4] has demonstrated by experiments on guinea-pigs that particles of food remaining in the tonsillar crypts conveyed tubercular infection to the ganglia of the neck. Although milk and diseased meat are the principal ingesta which convey the tuberculous infection, it is well to bear in mind that food in itself free from the germ may serve as a medium of contagion by bacilli brought to its surface through dust, as in the case of the grapes mentioned; through contact with contaminated tuberculous persons; or through the utensils with which it is prepared or served. Flies, also, which have had access to tubercular sputum, may do it, as the following experience of Hoffman, of Dresden, illustrates: Finding flies in a house where a patient had died of advanced tuberculosis, and whose sputum had contained great quantities of tubercle bacilli, he took them

[1] "The Vital Statistics of an Apache Indian Community," by W. C. Borden, M.D., Boston Medical and Surgical Journal, July 6, 1893.

[2] Annual of Universal Medical Sciences. Sajous, 1895.

[3] Revue de la Tuberculose, 1896, July.

[4] Lyon Médical, December 16, 1894, quoted in Sajous' Annual, 1896.

home and examined them. Tubercle bacilli were found in their intestines, at first in large and subsequently in smaller quantities. Their excretions, which covered the walls of the house in the form of numerous specks, also contained tubercle bacilli.

Tuberculosis is a comparatively common disease of cattle, and, as I have said, can be communicated to man through the milk and flesh. It is a danger always present and always to be taken account of, for these articles are universal staples of food. Villemin[1] states that 2000 bottle-fed babies die every year in Paris from tuberculosis.

Ollivier[2] reports the following experience illustrating the danger of infection from milk. "At a school for young girls there occurred within three months eleven cases of tuberculosis, of which five were fatal; and, with many, the site of the infection seemed to be intestinal. Two other pupils of the same school died of tuberculosis, in whom the family history and previous state of excellent health warranted the statement that they otherwise would not have been infected. Upon investigating the cause of this frightful occurrence, it was found that during this period the school had obtained its milk-supply from a cow which had shown, on post-mortem examination, advanced tuberculosis of the lungs and peritoneum, and more particularly of the udder."

As to the avoidance of this danger from tuberculous animals, it is possible, I believe, practically to abolish it by strict governmental and State inspection, which has already been instituted in many States, but often very imperfectly. All herds of cows kept for milk should be tested with tuberculin, which rarely, if ever, fails; and those animals reacting to this test should be removed from the herd, and either killed or kept apart for a time under observation. The Minneapolis Board of Health compels the farmers who supply that city with milk to test their herds with tuberculin. As there is less danger from the meat of tuberculous cattle[3] than from the milk, less strict measures will probably suffice. Those that exhibit clinical evidence of tuberculosis should be killed; and those exhibiting suspicious signs of the disease should be tested with tuberculin, and if a reaction is obtained, they should be either destroyed or kept apart under observation for a time. If all animals slaughtered for meat are not inspected, or all meat exposed for sale is not, which would be the more perfect way, at least all suspected animals or those from suspected herds should be examined, the internal organs as well as the muscular portion. Milk-dealers should require those who supply them with this article to give proof that their cows have been tested with tuberculin and found to be free from tuberculosis. So long, however, as inspection is not absolute or complete, the

[1] Annual of Universal Medical Sciences. Sajous, 1890. [2] Ibid., 1892.
[3] "La Virulence des Viandes Tuberculeuses," par E. Leclainche, Revue de la Tuberculose, 2, 1894.

only safety is in boiling the milk, and a temperature of 167° has been found to destroy the bacilli.

In a recent article by L. Emmett Holt[1] the conclusion is reached, from the study of 119 autopsies of infants and young children, that infection through the alimentary canal is rare and will not explain more than 1 or 2 per cent. of the cases. In the vast majority, he thinks, the infection is through the respiratory tract. Granting this, the danger is always present that milk from an unknown source, such as is generally the case when it is exposed for sale in the small groceries, may be tuberculous, and the only safe rule is to boil it. The poor especially should be taught to do this. The well-to-do generally use either sterilized or Pasteurized milk for their bottle-fed babies. Why should one use raw milk any more than raw meat?

Roth[2] shows that butter can contain tubercle bacilli, and out of twenty samples purchased in the different Swiss Cantons two contained the bacillus. There is, he says, no way to destroy the germ in the butter. Our only safeguard, then, seems to be to use only milk from tested cows.

Tuberculosis can also be conveyed by the flesh of the fowl. Renzi[3] says that he has not infrequently found evidence of tubercular disease in the abdomen of fowls; and instances are on record of infection produced in man by eating the flesh of tuberculous fowls. In Paris statistics have shown that it affects 23 per cent. of the poultry.[4] Pork and the flesh of various other domestic animals has also been shown occasionally to contain tubercle bacilli.

The entrance of the tubercle bacilli through the skin, by means of a wound or abrasion, is a possible means of infection, although not a common one. The washing of infected garments, handkerchiefs, towels, bedding used by tuberculous patients, may infect the laundress if she happens to have or causes a break in the continuity of the skin on her hands or arms. Attendants upon consumptives may infect themselves by a wound from a broken cuspidor. A case is related by Harris and Beale[5] of a cook who wounded one of her fingers with the fragments of a broken vessel containing sputum. Infection ensued, causing enlarged lymphatic glands in the elbow and axilla. The finger was finally amputated, the diseased tissue removed, and the glands extirpated, resulting in recovery. Physicians, surgeons, and medical students may become locally infected in making autopsies, in operations upon tuberculous bones, joints, and glands, and in anatomical dissections. Butchers and handlers of hides have also contracted it from tuberculous cattle.

[1] Medical News, December 12, 1896, p. 656.
[2] Corresp. für Schweizer Aerzte, September 1, 1894, p. 521.
[3] Lungenschwindsucht, 1894.
[4] "Animal Tuberculoses and their Relation to Human Tuberculosis," Nocard, 1895.
[5] "Treatment of Consumption." Philadelphia: P. Blakiston, Son & Co., 1896.

Tuberculosis, like syphilis, has also been conveyed by the Jewish rite of circumcision, in which the operator frequently sucks the wound with his lips.

Dr. J. C. White ("An Etiological Puzzle," *Boston Medical and Surgical Journal*, December 5, 1895) speaks of a case of tuberculosis of the lobes of both ears. They had been bored by a woman who died soon afterward of consumption, and they were dressed by a sister who died soon afterward of quick consumption. They were also bathed with cow's milk after the operation. In some of these ways infection was produced.

He also mentioned a case of tuberculosis of the hands of a mother and daughter who had habitually washed the handkerchiefs and other receptacles of the sputa from a tuberculous father.

Fortunately, however, the infection has a tendency to remain localized. When one has much to do with tuberculous individuals, it is wise to protect all abrasions or wounds of the hands with collodion or in some other safe manner.

As there can be no tuberculosis without the specific bacillus, the great contest against the disease must be fought out with this micro-organism, and first it must be clearly understood that it is *possible* so to restrict the germ that in the future the disease may be as rare as it is now common. Since writing this last sentence I find the following corroborative testimony in a supplementary report of the New York City Board of Health, just published: "We fully believe that with proper regulation, tuberculosis may be restricted within the narrowest bounds, and eventually, perhaps, almost exterminated. This is not the idle dream of sanitary enthusiasts, but is a conviction founded upon the most thorough and conclusive experimental investigations, which have been amply confirmed by practical experience."

We have only to destroy the sputum, and the deed is accomplished, for from the pulverized sputum the majority of cases take their origin. Tuberculosis from other sources is so insignificant in comparison that we may almost disregard it. This seems to be, and is, simple enough, but its very simplicity leads to a disregard of the measures which accomplish it.

There are two principal ways in which we may set about it. First, compulsory notification, isolation, and disinfection, as in the case of other infectious communicable diseases, such as diphtheria and measles. Second, by the enlightenment of the public as to its danger and avoidance. This can be done by societies for the prevention of tuberculosis, like the one in Pennsylvania, by Boards of Health—State and city—by physicians among their clientage; by notices in all public places as to the danger of spitting upon the floor and wherever the sputum may dry; by instruction in schools; by the public press; and in any and all ways

by which the subject can be brought to the public notice. Compulsory notification already exists in some States and cities, as in Michigan, Buffalo, and quite recently in New York City. It is no new thing, for a hundred years ago the King of Naples issued the following decree:

"Every physician is henceforth required to report to the authorities every case of consumption the instant it is recognized. Failing this, a fine of four hundred ducats ($400 to $900) will be exacted; and for a second offence banishment for ten years. Poor patients shall at once be taken to the hospital. Their clothing and linen shall be kept and cared for apart from those of other patients, and an inventory be made. In case of death every article must be produced and identified by the hospital superintendent. Any infringement of this rule may be punished by imprisonment or the galleys. It is the duty of those in authority to renovate the room of a former patient—floor, hangings, and furniture coverings; to burn the window-frames and doors, and replace them by new ones. The extreme penalty of the law will be visited on any one buying or selling the effects of phthisical patients. Every house where a consumptive dies shall be blacklisted." If the danger from the sputum had been known, equally drastic measures would undoubedly have been commanded regarding its destruction.

"In Rome, at least, and I suppose throughout Italy, strict and rigidly enforced laws of notification and disinfection still exist. When a notification of a case of tuberculosis is received, the house is visited by a medical sanitary inspector. He gives complete instructions to the attendants or family. The attending physician is obliged to see that all handkerchiefs, night-dresses, bed-linen, etc., are thrown into a receptacle containing proper disinfectants. At regular intervals the disinfectors call and remove the soiled articles, thoroughly sterilize them, then wash them, and return them to the owners. This is done at the municipal expense in the case of poor people. Others pay according to their means. It is forbidden to wash any article belonging to a tuberculous patient outside of the lazaretto. All rooms which have been occupied by tuberculous individuals are cleaned and disinfected in the most thorough manner, and a record kept by the authorities of all houses in which tuberculosis has occurred, which can be consulted by those desiring to hire or buy a house."—"Public Health in Rome," William G. MacDonald, M.D., *Boston Medical and Surgical Journal*, February 4, 1897.

The objections to compulsory registration are that the disease is slow and manifests great variations in its course, so that for a good part of the time the consumptive is able to be up and go about, and in many cases to pursue his usual vocation. To treat him, then, as a subject of contagious disease might isolate him to a certain extent and render it still harder to endure a lingering, painful, and, in many cases, hopeless disease. Another objection is that private business might suffer in

some cases, as, for instance, a tuberculous shopkeeper might lose his trade; or tuberculous individuals, still able and obliged to work, might be thrown out of employment, and thus cause great hardship to themselves and family.

Properly conducted, however, I think registration would not in reality produce the undesirable results feared, or work any great hardship to the consumptive or his friends; and, on the other hand, I believe it is fully justified, as a protective measure to the public exposed to an enormously frequent and dangerous infectious disease. As Bennet says,[1] "A diseased person in trying to save himself has no right to infect the sound public." Flick advocates registration at the breaking-down or infectious stage; but this, I am inclined to think, is an unnecessary limitation, for the majority of the cases would be at this stage when they came to the notice of the physician. If one could always depend upon the physician to see that proper precautions were employed as to the disposal of the sputum and disinfection in his consumptive cases, registration might be less necessary; but even physicians are sometimes careless, and in many cases a physician is only occasionally called in, or no physician is employed until late in the disease. Notification would simply mean that there was some responsible body who would see that the patient and his friends were advised as to the danger of communicating the disease and how to avoid it; and further to institute proper disinfection of the room which the patient had occupied or in which he had died. I cannot see that he would be materially disturbed or in any way made an outcast, as some claim; but, on the other hand, he would be assured that he was both protecting himself from reinfection and his friends and the public from infection; for a consumptive and his room can be rendered harmless if the sputum is properly disposed of.

Dr. Irwin H. Hance, in a paper read before the New York Academy of Medicine on January 21, 1897, gives his experiments with dust collected in hospitals, dispensaries, tenement-houses, and public conveyances. Three out of four guinea-pigs inoculated with dust taken from a tenement-room in which a phthisical woman had lived and died, died of tuberculosis; while four guinea-pigs inoculated with dust taken from a room where a patient with tuberculosis lived, but who observed the regulations of the Board of Health, showed no signs of the disease. He also found that in tenement-houses all the cleanly apartments were free from infection, thus proving "the wisdom," he says, "of granting the Board of Health power and authority to order such cleaning and renovation of tenements as is required."

For the poor, suffering from consumption, where preventive and dis-

[1] Sajous' Annual, 1890.

infectant measures are difficult or impossible of execution at their homes, on account of their poverty or ignorance, especial hospitals are needed where they can be isolated and kept from disseminating the disease as well as properly cared for. All civilized nations are now recognizing the importance and need of such institutions, and I have already noted the result of them in the case of England, where the mortality from phthisis has been reduced 50 per cent. in forty years. In the case of tuberculous individuals in the infectious stage, but still able or compelled to work, and to do so in close contact with others in shop, factory, or wherever they are a menace to those about them, I can see but one method to pursue—to remove them from their place of employment and either send them to a special hospital or a portion of a general hospital set apart for such cases, or give them a pension sufficient for their maintenance. If others are dependent upon them, some provision should also be made for them. It would, I am convinced, be economy for the State to do this, as it already does do in a similar manner in remunerating the owners of tuberculous cattle which it condemns. Moreover, the danger, I believe, warrants the step.

Innumerable sets of rules have been formulated for the disposal of the sputum and the prevention of the spread of the disease through the sputum, all essentially the same. The simpler and plainer they are, it seems to me, the better. I would venture to formulate the following.

How to avoid communicating consumption.

The expectoration—what is coughed up—contains the germs of the disease.

These germs will carry the disease *only* when the expectoration gets *dry*.

Only spit where the expectoration can be *destroyed* or kept *moist*.

Do not spit upon the floor anywhere, or in the street, or in the cars, halls, or in any vessel unless it contains water or a liquid disinfectant.

Always use a spit-cup when possible. If a paper cup is used, burn it every day, or oftener if there is much expectoration. If a glass or earthenware cup is used (a china coffee-cup will do) fill it half full of water, or a solution of carbolic acid, thirty drops to a pint of water. The cup should be thoroughly scalded with boiling water at least twice a day, and frequently boiled for half an hour.

Out of doors, where it is not possible to use a spit-cup, use pieces of cloth about ten inches square, handkerchiefs of cheap material or Japanese paper, and burn them as soon as possible. Do not allow the expectoration to become dry upon them, or use them more than once.

Great care should be taken that no particles of the expectoration lodge upon the hands, face, or clothing, or bed-clothing if in bed. If this happens they should be immediately washed off with hot water and soap.

The expectoration should not be swallowed.

The bed-clothes and linen of a consumptive should be kept separate, if possible, and boiled before washing.

Eating-utensils used by a consumptive should be washed separately, and, if possible, used by no one else.

A consumptive should sleep alone.

A consumptive should not work where he is compelled to handle the food or wearing apparel of others, or anything else which many others handle. If he is obliged to do this he should use every care to prevent any of his expectoration from getting upon his hands, upon the articles which he handles, or upon the persons upon whom he waits. He should not cough upon, or in the direction of, food or kitchen- or eating-utensils.

The living- and bed-room of a consumptive should be kept very clean and well aired, and should contain only the absolutely necessary articles of furniture. As much sunlight as possible should be admitted; and there should be constant ventilation night and day. A room with an open fireplace is to be preferred. There should be no dusting or sweeping, but a moist cloth should be used for cleaning.

A room that has been occupied by a consumptive, or in which a consumptive has died, should be thoroughly disinfected in the following manner:

Carpets, curtains, and bed-coverings should be exposed to superheated steam under high pressure, or where facilities for this do not exist, they, with all stuffed furniture, should be thoroughly shaken and brushed, and exposed to the open air and sunlight for several hours. The floor and walls of the room should be rubbed with new bread, followed by the application of a 1 per cent. solution of chloride of lime, or a corrosive sublimate solution (1 to 500); ceilings should be thorougly dusted and whitewashed. Every corner wherever dust is likely to lodge should be carefully cleaned. The windows should be left open for twenty-four hours. Prof. E. P. Pfuhl[1] has found that formaldehyde gas will readily destroy tubercle bacilli. This gas can be easily generated from methyl (wood) alcohol, and it would seem to be an efficient, cheap, and easy method of disinfecting a room and its contents without injury to them.[2] It would be a wise and economic step if town authorities should provide disinfecting apparatus, which could be used for other infectious diseases as well as tuberculosis.

"In Rome, Italy, after a death from tuberculosis the following is the method of disinfection: If the floor be carpeted, they first spray with corrosive solution, 1 to 500, combined with chloride of sodium, so that no dust may arise. Then the carpet is removed, the floor being continually

[1] Zeitschrift für Hygiene und Infection Krankheiten, xxxii. 339.
[2] Further experience has proved the efficacy of this method.

wet under it during the process of removal. If a bare floor exist, it is immediately drenched with a plentiful supply of 1 to 3000 corrosive, combined with hydrochloric acid. All carpets, bedding, mattresses, portières, curtains, clothing, or anything of like nature are rolled up in sterilized sheeting and removed, to be treated in steam sterilizers. The walls are then thoroughly drenched with corrosive, 1 to 500, and chloride of sodium. This drenching is done with a small hand-pump. After the drenching a vigorous scrubbing takes place, and, if need be, a vigorous scraping, too. Each chair is taken to the tub and thoroughly scrubbed with the solution. Stuffed furniture is treated with the corrosive and sodium solution, which they consider harmless. Metal articles, such as brass beds, are rubbed over with a phenic-acid solution. Water-closet bowls are swabbed out with slaked lime. Landlords are then obliged to paint, paper, and whitewash the rooms at their own expense."—"Public Health in Rome," William G. MacDonald, M.D., *Boston Medical and Surgical Journal*, February 4, 1897.

In schools, teachers should admonish the scholars as to the danger of spitting upon the floor, and cuspidors should be provided.

Spittoons, says Cornet, and the writer agrees with him, should be placed wherever it appears necessary, in every enclosed space frequented by men; in hotels, restaurants, places of amusement, workshops, factories, counting-houses, corridors, stair-landings, railroad stations, steam-cars, street-cars, steamboats; and on the wall near each spittoon there should be a notice: "Spittoon for those troubled with cough or who have to spit. Spitting on the floor is dangerous and the means of carrying disease." These spittoons should be eight to ten inches in diameter, two inches high, smooth, slightly inverted edges, made of strong, smooth glass, porcelain, earthenware, or enamelled iron, and should contain water to the depth of half an inch.

In medical out-patient departments of hospitals and dispensaries, circulars with plain, simple directions as to the avoidance of tuberculosis should be given each patient, and to the tuberculous ones, in addition, rules for disposing of the sputum. In the waiting-rooms of these institutions spittoons should be provided, and notices as to the danger of spitting on the floor posted. Dr. Hance[1] has demonstrated the existence of tubercular dust in the waiting-room of a dispensary. Street-cars are now beginning to have notices posted in them forbidding spitting. The following is the one seen in the Boston cars:

"Health Department of the City of Boston, October 13, 1896.

"The Board of Health hereby adjudges that the deposit of sputum in street-cars is a public nuisance, source of filth, and cause of sickness, and hereby orders that spitting upon any floor of any street-car be, and hereby is, prohibited."

[1] Loc. cit.

A shorter and simpler one would seem preferable for accomplishing the object, when one considers the various nationalities who travel in the cars, and their limited knowledge of English.[1]

The cleansing of all places where many people congregate should be thorough, and dry sweeping abandoned. Especial and thorough disinfection should be practised, at the end of the season, in hotels at health resorts frequented by phthisical patients, and at frequent intervals in cars where such patients travel, as on some of the Southern routes. Petri[2] and Prausnitz,[3] in experiments upon the disinfection of railway carriages, found that simple washing with soap and water was quite efficacious.

The streets of cities and in thickly settled portions of towns should be kept well watered and dust not allowed to blow about, as one often sees it in the wake of a horse-sweeper. Sweepings from shops and stores should not be thrown into the streets.

If these various measures were rigidly observed, there is no doubt that a constant and marked diminution of the disease would be quickly observed; indeed, facts have already proved this to be so, for since 1887, when the German authorities instituted prophylactic measures, the mortality from the disease in Prussian prisons, for instance, has steadily diminished. Before these measures the deaths per 10,000 inmates from tuberculosis were 118.9 from 1875 to 1876; 140.8 from 1878 to 1884; 174.7 from 1884 to 1887. After the prophylactic measures 101 from 1887 to 1890; 89.4 from 1890 to 1892, and only 81.2 from 1892 to 1894. In Prussia from 1875 to 1886 the general mortality from tuberculosis was more than 30 per 10,000 inhabitants; since the application of prophylactic measures it has fallen below 25, and a similar diminution is noted in other German States.[4]

THE FAVORABLE SOIL. We come next to the consideration of the *favorable soil*, which must exist conjointly with the bacillus in order to produce the specific infection. Exactly what constitutes this receptive state it is difficult to say, but we may define it in general as a condition of health below the normal standard, either temporary or chronic, with a coexistent, weakened pulmonary tissue. If we do not always know precisely the physical state which offers the favorable soil, we do know innumerable conditions which experience has proved to be conducive to it, as well as innumerable causes which produce these conditions—causes existing or developed either in the individual or in his environment.

(*a*) *The individual.* Regarding inheritance, most authorities now agree, I think, that only a *tendency* to the disease at the most is meant

[1] Since writing the above a simple statement that spitting is prohibited under a penalty of $100 has been substituted.

[2] Revue de la Tuberculose, 1894, p. 16.

[3] Deutsche medicinische Wochenschrift, June 12, 1894.

[4] Cornet: Le Bulletin Médical. Paris, May 26, 1895.

by the term; and the facts are ostensibly in accord with this interpretation of the word. Genuine, direct inheritance of the bacillus from the mother to her infant has been proved to be possible, although exceedingly rare. I am obliged to express serious doubt, nevertheless, that even a *tendency* is inherited. It seems to me that the apparent fact is explicable thus: descendants of consumptives are very frequently born with lowered vitality, poor physical development, and a lack of vigor, constituting a diminished "resistance potential." This condition is often still further accentuated by the mode of life followed. From the very fact that there is a lack of muscular development and vital force, a sedentary, indoor occupation is naturally chosen, which still further depresses the system and weakens the pulmonary tissue as well as increasing the opportunities of bacillary infection. Let the same conditions exist in one not born of consumptive ancestry, and I believe there would be as great a likelihood of contracting the disease as in the former case. In an analysis of 100 city men of various occupations I obtain the following suggestive results:

Sixty-two of indoor occupations had fathers of indoor occupations also.

Sixteen of indoor occupations had fathers of outside occupations.

Six of outdoor occupations had fathers of indoor occupations.

Sixteen of outdoor occupations had fathers of outdoor occupations.

Thus is shown the strong tendency from the more wholesome outdoor life to the less wholesome indoor.

On the other hand, given a strong, robust individual, well developed, and of good vitality, born of consumptive ancestry—a condition not infrequent—and I believe he is no more likely to suffer from pulmonary tuberculosis than one of like physical condition born of parents with no phthisical taint in their ancestry. At least, there is no doubt in my own mind that many cases of consumption attributed to inheritance are in reality caused by the same vicious conditions under which the parents lived and by the greater opportunity of exposure to the bacillus. This, I think, is at least a partial explanation of the large number of cases of apparent inheritance (107 out of 232) in the analysis of the 232 hospital cases (vide table). Of course, many other causes also incident to their mode of life and occupation played an important rôle in causation.

Granting an inherited tendency, it is but small. Edward Squire, of London,[1] made an analysis of 1000 cases, and concluded that the influence of heredity could not be placed higher than 9 per cent of cases among children of phthisical parents in excess of the cases occurring among the children of non-phthisical parents. He also continues to say

[1] Lancet, December 15, 1894.

that hereditary influence in phthisis is not a true heredity, but a tendency to suffer from disease—tuberculosis among other complaints—which the offspring of phthisical parents has in common with the children of weakly parents, from whatever cause this delicacy may arise. The children of phthisical parents contract the disease earlier because they are exposed to the infection at home. The family house and its surroundings are, therefore, much more dangerous than the pedigree.

In the 2700 young men I examined (vide table) but 5.9 per cent. had lost one or other parent from consumption. I must confess myself, then, from the foregoing reasons, quite in accord with Whittaker's conclusions that "The idea of a predisposition is dangerous, because it removes attention from the avoidable sources of the disease. It is unsatisfactory, because it does not prove enough. It is also undemonstrable, and the experiments made to prove it are all open to objection. Finally, it is superfluous."[1]

But whatever may be the family history, every person of imperfect muscular development, low vitality, and deficient respiratory capacity —all indicating a diminished "resistance potential"—is a possible candidate for the bacillus, and should receive especial training and attention to remedy as far as possible this congenital or acquired condition. From a child up, he should be carefully watched. If his mother is a consumptive, she should not nurse him. Nutrition, respiration, exercise, rest, clothing, fresh-air supply, and place of abode should all receive careful attention. Such a person should live an outdoor life so far as possible.

Whenever, in the remote past, pulmonary tuberculosis first originated it was probably coincident with the building of closed places of abode, for it is, for the most part, a disease of indoor life; and this fact cannot be emphasized too strongly in all discussions upon its prevention. We seem to have reversed the natural order of things, and instead of regarding indoor life the exception, we make it the rule. Even when we transfer ourselves from one abode to another we do not enjoy the fresh air in transit as we often might, but enter a closed vehicle, like a street-car, almost invariably filled with impure air and foul smells. We have grown so accustomed to this abnormal life that its dangers are lost sight of, but they are not the less real, and especially menace those of deficient vitality whom we have been considering. For them, at least, outdoor life and occupation is most desirable.

Of the many predisposing causes existing or developed in the individual we have, first in importance, malnutrition and defective assimilation, and these again are produced by a variety of causes; dyspepsia is a common one. As some one has said, "Stomach troubles are power-

[1] An American Text-book of Therapeutics, 1896.

ful predisposing causes of tuberculosis." Of the 2700 young men I examined, dyspepsia was complained of in about 15 per cent. Insufficient and improperly cooked food, rapid eating or eating when exhausted, decayed teeth or absence of teeth, irregular habits, lack of or insufficient physical exercise and fresh air; intemperance in eating and drinking are all causes of dyspepsia, and their mention suggests the remedy. Good teeth are a very valuable safeguard against pulmonary tuberculosis, and free dental hospitals or clinics for the deserving poor, as advocated by Dr. R. C. Newton,[1] would, I believe, remove a not insignificant factor in the causation of the disease among this class of people. The custom now so largely prevalent of protecting the first dentition until the second arrives is undoubtedly a valuable means of protection against the entrance of the bacilli through a carious cavity or a cavity from which a tooth has been extracted, which is a real danger, as I have shown above.

Dyspepsia, moreover, is often the direct prelude to phthisis, and when accompanied with loss of weight and appetite, a quickened pulse, and, perhaps, a slight rise of temperature, an examination of the lungs ought always to be made, and the individual kept under careful observation. I vividly recall the case of a young woman who consulted me for what apparently seemed to be a case of ordinary dyspepsia, and in whom I neglected to make a physical examination of the lungs. She developed phthisis subsequently, of which she died. In such cases a spirometric test is of value, as advocated by Otis.[2] Anæmia, which is also a result of dyspepsia, as well as various other depressing conditions, is a prolific predisposing cause, and its origin must be sought for and remedied. Indoor life, insufficient rest, deprivation of sunlight, exhausting discharges, irregular habits, and worry are some of its causes. Intemperance in alcohol, especially among the working people, is another frequent cause. In the 232 consumptives treated in the hospital (vide table at end) I obtained a history of alcohol to excess in ninety-five. Probably the alcoholic habit was accompanied in most of the cases by irregular habits and exposure which intensified its injurious influence, as in the case of teamsters, who contributed 6 per cent. in the above number of consumptives.

All exhausting discharges, particularly leucorrhœa, menorrhagia, excessive lactation and rapid child-bearing, sexual excesses, depress the system and lower the "resistance potential." Amenorrhœa is frequently a danger-signal and evidence of that anæmia which precedes the tubercular outbreak. Imperfect convalescence from pneumonia, pleurisy,

[1] "What Shall be Done for the Teeth of the Poor?" Read before the New Jersey State Dental Society, August 3, 1895.

[2] "Some Methods of Chest Examination Supplementary to Auscultation and Percussion." Reprint, 1895.

bronchitis, influenza, or diphtheria leaves the pulmonary tissue in a particularly susceptible condition, and the general system in a depressed state. Respiratory gymnastics are of great value in these cases, to which I shall refer again in speaking of respiration. The childhood diseases of whooping-cough, measles, and scarlet fever are also frequent predisposing causes, and very much in the same way as the cases of imperfect convalescence. Strictly enforced notification laws, isolation, thorough disinfection will best reduce this danger, and we ought to consider it the exception for a child to contract any of these diseases, instead of the rule, as is too much the case now. The present system of daily school inspection by a health officer, practised in some of our cities, is a valuable preventive measure.

The so-called "neglected cold" is often adduced as a frequent exciting cause of pulmonary tuberculosis, and when one considers the number of colds the community suffers from in this climate, such would seem to be the fact. In the 2700 men examined, 41.4 per cent. complained of colds in the head or throat; and in the 232 consumptives, seventy-nine attributed the exciting cause to a cold. The underlying cause, however, is to be sought for. What causes the colds? Impure air, dust, extreme and sudden alternations of temperature, excessive indoor temperature, dry heat, lack of physical exercise and inadequate respiration, neglect of daily cold bathing of the throat and chest, an excessive amount of clothing, insufficient sleep and rest, mouth-breathing, excess in eating and drinking, constipation. These neglected colds, or frequently recurring catarrhal affections, whatever the underlying cause, "may form predisposing causes," says Webber,[1] "either by producing sore places in the mucous membrane and thus allowing the bacilli to settle, or by weakening the epithelial cells of the mucous membrane and their ciliary action, or by causing imperfect breathing from unconsciously avoiding deep inspiration in order to avoid coughing, or by weakening the nutrition and energy of the whole system."

The treatment is not by futile attempts to avoid exposure, and by indoor coddling, but by hardening, exposure to the outdoor air in almost all weathers, free ventilation when indoors, sponging the chest and throat with cold water every morning, woollen underclothing of moderate thickness, physical exercise out of doors and in the gymnasium.

The nasal cavities, post-nasal spaces, and tonsils are all possible sources of infection. Dieulafoy[2] took fragments of hypertrophied tonsils and adenoid vegetations and injected them into guinea-pigs. Out of sixty-one hypertrophied tonsils he found eight tuberculous, and in thirty-five cases of adenoid vegetations seven were tuberculous. Strauss[3] has shown the presence of tubercle bacilli in the nasal cavities of healthy

[1] "Chronic Pulmonary Phthisis," 1885.
[2] Revue de la Tuberculose, vol. iii., 1895.
[3] Revue de la Tuberculose, vol. ii., 1894.

individuals associating with consumptives more or less constantly as attendants, nurses, etc. (presumably when the sputum was not properly disposed of). In twenty-seven well persons nine were found to have virulent tubercle bacilli in their nasal cavities. So long as the nasal epithelium remains intact the bacilli are harmless, and we have what M. Verneuil called "latent microbism." If, however, the epithelial barrier is broken through, the microbism may become an active one, as Louis has shown in the case of young subjects who have become tuberculous after repeated attacks of epistaxis.

Whenever, then, hypertrophied, spongy tonsils or adenoid growths exist, as they so frequently do in children, they should be removed; not only, as has just been shown above, do they offer a favorable soil for the bacillus, but, also, by partially occluding the upper respiratory passages, interfere with full free respiration, and so diminish the lung capacity and limit chest expansion. The so-called "chicken-breast" is not infrequently the result of such obstruction. The anterior nasal passages should also be kept freely open, and any defect in the physiological action of the mucous membrane—hypertrophy or atrophy—remedied.

Enlarged cervical glands, a very common occurrence in childhood, and from a variety of causes, are in a certain proportion of cases tuberculous, as is illustrated in the case of the carious teeth I mentioned earlier in the paper. Valland[1] maintains that tuberculous infection of the lungs in later life is secondary to tuberculosis of the lymph-glands in childhood, and in 101 out of 108 tuberculous individuals he found enlarged cervical glands. Among 2506 persons examined, enlarged cervical glands were found between the ages of seven and nine in 96 per cent.; between ten and twelve in 91.6 per cent.; between thirteen and fifteen in 84 per cent.; between sixteen and eighteen in 69.7 per cent.; between nineteen and twenty-four in 68.3 per cent. Tubercle bacilli were found in the cervical lymph-glands in about 68 per cent. of adults.

Enlarged cervical glands are always a menace to the individual both from the possibility that they may be tuberculous, or become so, and from the depressing effect upon the general system, particularly if they break down and suppurate. They may be caused by carious teeth, hypertrophy of the tonsils, purulent otitis, eczema of the head, irritation from pediculi capitis, adenoid vegetations, and other irritative causes. They are also common in children, apparently as a local manifestation of an anæmic condition resulting from malnutrition and an unhygienic environment. They are to be treated generally and locally. All sources of irritation are to be sought for and removed. If the glands are few, or

[1] Annual of Universal Medical Sciences. Sajous, 1895.

there is but a single one, and their position and depth render their removal a comparatively simple operation, I should advise total extirpation. I have had most satisfactory results from this procedure. In non-suppurating glands Ingals, of Chicago,[1] suggests the injection of lactic and carbolic acid, from 15 to 40 per cent. of the former and 2 to 5 per cent. of the latter, and he narrates a successful case from this treatment. If there is suppuration, the gland can be thoroughly scraped out, as advised by Mr. Treves, or drained with a Briggs[2] canula; or it can be drained through a small opening, washed out with peroxide of hydrogen, and the cavity filled with iodoform emulsion. External applications have proved almost, if not quite, useless in my hands. For general treatment, good hygiene, pure air, sunlight, nourishing food, iron, arsenic, and cod-liver oil. Experience has proved that sea air and bathing are most beneficial in such cases; hence the many sanitaria in Europe, on the coasts, for strumous children.

An unstable nervous state or a depressed nervous tone interferes with the healthy normal functions of the body, and so reduces its "resistance potential." Loss of sleep, or frequently interrupted sleep, worry, despondency, disappointment, long or extreme mental application, all depress the nervous system. When one is obliged to be much with the disease, and long at a time, great care should be taken to maintain the nervous system in a normal condition by an abundance of sleep in a well-ventilated room, sufficient exercise and change, and freedom from worry and other depressing influences.

It is noways unlikely, it seems to me, that too much and too heavy clothing has been one of the predispoing factors to the disease far more frequently than insufficient clothing. The old idea is still commonly entertained that a consumptive must be smothered in clothing and incarcerated in a tight, superheated room. The neck-muffler and chest-protector are still in common use. The only safety for weak lungs is to develop and strengthen them by use in pure, out-of-door air, and to promote a vigorous condition of the whole body by exercise, cold bathing, and exposure in the air; heavy clothing and inactive indoor life only increase the existing local and general weakness. Woollen underclothing is advised, for it preserves an equable skin temperature better than other fabrics; but it should not be too thick or heavy. The garments should be loose, and for women the "Flynt waist" is admirable. Cold bathing, to which I have just referred, is useful in giving tone to the nervous system, as well as promoting the activity of the skin. It plays an important rôle in the treatment of tuberculosis in all the European sanitaria. It can be applied in various ways: the simple sponge bath, either of the entire body or of the chest and neck; the

[1] Transactions of the American Climatological Association, 1896. [2] Ibid., 1896.

spray needle, or shower bath, and the wet-pack. It is well to gauge accurately the temperature of the water by the thermometer. Public baths in the larger cities of this country are becoming more common, an admirable example of which is the one recently erected at Brookline, Mass., with its swimming-tank eighty feet in length. These, together with improved construction in tenement-houses and stricter factory inspection, increase the "resistance potential" in the poor and help to establish individual immunity. The air-bath and sun-bath are also valuable supplements of the water-bath, or can be used alone.

Inadequate and partial respiration is, I am convinced, a frequent predisposing cause of tuberculosis, and also a very common condition. Not only is the resisting power of the lung tissue diminished, but the aëration of the blood, upon which depend so largely all the vital processes, is imperfectly performed. Full and free respiration strengthens the pulmonary tissue, increases its vitality, and consequently its "resistance potential." By a habit of full and deep breathing, once established and persisted in daily, "one is fortifying himself," says Otis,[1] "against the possibility of disease of the lungs by thus maintaining the pulmonary tissue in an active, healthy, and well-nourished condition; and there is no portion of the apices which, from insufficient use and poor nourishment, is a menace to the individual by offering a fitting soil to a wandering bacillus. In convalescence from pneumonia and pleurisy with effusion, the importance of expanding and revivifying, as soon as possible, the lungs whose functional capacity has been diminished and whose nutrition has been depressed, can hardly be overestimated." The especial respiratory exercises are simple and yet efficacious —standing erect and making long, deep inspirations and slow expirations; combining the arm movements with the respiratory act by raising them to a horizontal position, and then over the head until the hands meet, slowly and deeply inspiring while performing the movement, and expiring while lowering the arms; raising the arms and carrying them back and down, describing a movement of circumduction; extending the arms in a horizontal position and bringing them forward and then sharply back. Then there are various exercises with wands, and if one has access to a gymnasium, the various devices there for increasing the lung capacity and developing the respiratory muscles, the "chest developers," "lung expanders," quarter circle, or many of the heaving movements of the Swedish system. Of course, there is an infinite variety of general exercises which produce a more energetic respiratory activity, such as swimming—most excellent for increasing the lung capacity—skating, tennis, running, jumping, bicycling, rope-jumping, hill-climbing, dancing, and the like.

[1] "The Value of Respiratory Gymnastics," etc. Boston Medical and Surgical Journal, May 28, 1896.

(*b*) *The environment.* In the question of environment and the part it plays in the causation of tuberculosis there enter various considerations: the climate, one's abode and place of occupation, character of the soil and subsoil, drainage, ventilation, opportunities for light and sunshine. I do not believe that climate directly plays an important rôle in the causation of phthisis, although it is a most potent factor in its treatment; for the disease, as I have said, exists in every climate, from the Arctic zone to the tropical regions. Indirectly, however, its influence is felt, when, for instance, on account of its severity, one is compelled to live indoors a large portion of the year, for indoor life has its especial dangers, as all artificial life does. When one can choose the situation of his abode, it should be upon a dry foundation, either naturally so or made so by drainage, for soil and subsoil dampness has been shown to be a potent predisposing factor. In Salisbury, England, the mortality from phthisis was reduced 50 per cent. by deep and thorough drainage of the subsoil.[1] The construction of the dwelling should be such that an abundance of light and sunshine can enter; sunshine is one of the best bacillicides. A supply of fresh air and the escape of foul is also to be provided for. When the rooms are small, either in a dwelling or shop, if a constant current of air is maintained, the living conditions will be wholesome. Especially necessary is it that sitting and sleeping rooms should have constant and thorough ventilation, and this can often be attained by some of the simple means of window ventilation in conjunction with an open fireplace. Night air is not only *not* injurious, as many think, but, on the contrary, it is often purer than day air, which contains more dust from the movements of the various day activities. In the majority of cases, for a dwelling-house, the best combination for ventilation and heating is probably the hot-air furnace and the open fireplace. With the increasing interest in tenement-house reform, the erection of model structures of this class will insure to the poor, it is to be hoped, adequate provision for ventilation, cleanliness, and light. Back-to-back tenement houses on narrow, dark alleys or "places" are prolific breeders of phthisis, not only by disseminating tubercle bacilli, but by preparing a favorable soil for them. It is well to recall Trudeau's noted environment experiment here. He inoculated a number of rabbits with the same quantities of tuberculous virus. Half of them were allowed to run free in the open air, and the other half were placed in a dark hole under ground. They were all killed at the same time. Those which had run free had either recovered entirely or showed only localized lesions, while the other half showed wide dissemination of the disease. In workshops and factories careful and frequent inspection should require proper ventilation and

[1] Ransome: "The Treatment of Phthisis," 1896.

freedom from dust. In churches, school-houses, theatres, libraries, public halls, reading- and recitation-rooms, where inadequate ventilating facilities or neglect of their use are so common, the remedy must come both by educating the people as to the dangers of impure air and by municipal or town inspection and control. If it is considered necessary to detail an officer at any assembly to see that order is maintained, at least equally important is it for the well-being of the assembled crowd to have an inspector on hand to see that they breathe pure air. How common an experience it is to find a country church filled with a drowsy audience, breathing foul and stagnant air, while the pure winds of heaven surrounding it on all sides are sighing for entrance. As Ransome[1] well says, "The ventilation of ball-rooms, concert-halls, theatres, and places of worship is a scandal to civilization."

I have frequent occasion to pass through a large reading-room, invariably redolent of stale and malodorous air, where no apparent means of ventilation exists or is thought of, although thousands of dollars have been expended upon abundant and varied literature, probably containing among it excellent treatises upon ventilation. What better arrangement for cultivating a favorable bacilli soil!

In cities and large and thickly settled towns, it is of vital importance that there should be abundant and ample air spaces, by wide streets and frequent small parks. Narrow and blind alleys, which do not allow a sweep of air through them, and act as cul-de-sacs for stagnant, impure air, ought not to be allowed. Steam-cars and street-cars in the winter in this climate are generally almost hermetically sealed, and every one is familiar with the evil odor of foul air which greets him on entering a street-car from the outer pure air. It seems well-nigh hopeless to convince the average traveller that air breathed and rebreathed is more dangerous by far than cold air or draughts. The remedy must come through the management of lines of travel and the slow enlightenment of the travelling public. Who ever thinks to inquire whether a steam or electric car is thoroughly aired out after a journey before beginning another?

One's occupation, as well as the conditions under which it is pursued, may be a predisposing cause of tuberculosis, by directly weakening the lungs as well as the general health. Those employed where there is much dust, such as stone-cutters, knife-grinders, potters, dyers, wool-carders, cigarmakers, polishers, and the like, especially when the work is carried on in confined spaces, have always suffered a large mortality. Dr. Greenhow calculated[2] that 45,000 deaths occurred annually among those thus employed in England and Wales, and he believed that the whole of this mortality was preventable by the introduction of better methods of ventilation and working.

[1] "The Treatment of Consumption," 1896.

[2] J. Edward Squire: "The Hygienic Prevention of Consumption," 1893.

Printers, compositors, tailors, dressmakers, bakers, and those who work in ill-ventilated, poorly lighted, and damp places, or where smoke and various irritating gases are generated, contract phthisis readily. Teamsters are also frequent sufferers from the disease, probably from their irregular life and alcoholism.

The only way of reducing the mortality from these unwholesome occupations is to make the hours of labor short and the conditions under which they are pursued as favorable as possible. There should be rigid State inspection of all places where they are followed. Sufficient air-space and ventilation should be required; every means known to dispose of the dust, and, if necessary, respirators should be provided for the workmen.

I have endeavored in the above, with more or less completeness, to portray the causes and conditions of pulmonary tuberculosis; the danger from the tubercle bacillus on the one hand, and from a diminished "resistance potential" on the other. I have also indicated the means of prevention. When one considers the almost innumerable number of these causes which promote a tubercular state he may well be appalled, and feel inclined to abandon all attempts at prevention as hopeless. On the other hand, however, what has already been accomplished, as I have shown above, encourages one to continue the struggle and increase his exertions against this most destructive disease of modern times. To restrict the spread of the specific micro-organism and to fortify the body against its insidious influence, and increase the "resistance potential," are the two simple lines along which we are to advance in the contest. I firmly believe that it is possible, by a union of all the resources at hand—State and law, individual and organized exertions, enlightenment of the public as to the dangers of the dried sputum and their avoidance, and a utilization of all the means at our command to increase the general average of health—so to reduce the mortality from consumption that it may become one of the rarer diseases instead of the most common and fatal, as now. The medical profession has labored long and painfully, and with lamentably little success, in its attempts to cure the disease or discover a specific for it. Let it now turn its attention to prevention and enlist the public in its endeavors. The outlook is infinitely more hopeful in this direction; and prevention, whether one is dealing with crime, poverty, or disease, is better and more scientific than attempt at cure.

TABLE I.—ANALYSIS OF 232 HOSPITAL CASES OF PULMONARY TUBERCULOSIS TAKEN CONSECUTIVELY.

(Omitting a few cases in which no sufficient history could be obtained.)

Number of males	152
Number of females	80
Married	26
Single or unknown	54
Occupations of men:	
Indoor	91
Outdoor	53
Unknown	8
Occupations of women:	
Domestic or housework	47
Special occupations:	
Printers	5
Teamsters	14
Stone-cutters	9
Factory operatives	10
Dusty occupations	39 +
Laborers or other unskilled work (not incl. teamsters)	45
Skilled workers (generally indoor)	79
Father, mother, brother, or sister (one or more) died of pulmonary tuberculosis in	107
Out of 145 cases (in which some record was attempted, though imperfect) a history of continued intimacy as caretaker, wife, husband, etc., was given in	23
Alcoholics	97
Exciting causes given:	
Result of pleurisy	11
" " pneumonia	14
" " grippe	13
" " cold	79
" " hæmoptysis	15
After miscarriage or childbirth	6
Began with "cough"	47

TABLE II.—EXAMINATION OF 2700 APPARENTLY WELL YOUNG MEN.

	Per cent.
Complained of cold in the head or throat	42.6
" " dyspepsia	14.85
" " bilious attacks	10.96
" " habitual constipation	7.63
" " shortness of breath	9.2
Had had bronchitis	6.1
" " pneumonia	5.0
" " pleurisy	1.0
" " enlarged glands in the neck	3.5
" " spitting of blood	1.3
One parent had died of consumption in	5.9
Both parents had died of consumption in	0.2

ON NEPHRITIS OF MALARIAL ORIGIN.[1]

By William Sydney Thayer, M.D.,
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The fact that albuminuria may occur in the course of malarial fever as well as during other acute infections is well known.

Martin-Solon[2] estimated that it occurred in a quarter of all cases.

Laveran,[3] however, believes that this is a high percentage for the simple non-pernicious fevers.

Joseph Jones[4] refers to its occasional occurrence, but says: "In several hundred examinations of the urine of the different forms of malarial fever in the Marine Hospital of Savannah, Georgia, albumin was found in only one case, which was complicated with typhoid fever. This fact is important in its bearings upon typhoid and yellow fever."

Anders,[5] in 1780 cases collected from the records of various hospitals in Philadelphia, noted only eighteen cases in which albuminuria ("marked") was found.

Hertz[6] asserts that "It is no very uncommon thing to find albumin present in considerable quantities. . . . Albumin is to be found in the urine either only on the fever days or during the intermission as well (fibrinous tube-casts have also been observed) and diappears on recovery."

Atkinson[7] observed seventy-six cases of intermittent and remittent fever in which albuminuria occurred five times; in a second series, however, occurring during the late summer and fall of 1883, forty-five in number, albuminuria was noted in six instances.

Kelsch and Kiéner[8] say that in ordinary malarial fevers "The presence of albumin is not rare in paroxysms of a certain intensity, but it is particularly common in relapses in old sufferers where the kidney is already altered." They say that in the more severe bilious and gastric fevers (p. 453) "Albumin is frequent enough, but inconsiderable in quantity and transient; it may be intermittent and disappear with the paroxysm, or it may continue during the intermission."

Despite the relative frequency with which some observers have noted albumin in the urine of malarial patients, its presence or absence has been used as a point in the differential diagnosis between certain forms of severe malaria and yellow fever, in which latter affection the early appearance of albumin is the rule.

[1] Read before the Association of American Physicians, May, 1898.
[2] Gaz. Méd. de Paris, 1848, iii. s., T. iii., Année xix. 618.
[3] Traité du Paludisme, 8°, 1898, Paris.
[4] Medical and Surgical Memoirs, vol. ii. p. 772.
[5] Journ. of the Amer. Med. Association, 1895, vol. xxiv. p. 916.
[6] Ziemssen's Cyclopædia, American edition, vol. ii. p. 641.
[7] The American Journal of the Medical Sciences, 1884, vol. lxxxviii. p. 149.
[8] Maladies des pays chauds, p. 144.

McLean, in *Reynolds' System of Medicine*, says: "Albuminous urine is almost invariable in yellow fever, only occasional in remittent;" again, of the urine in remittent fever, he says: "It . . . seldom contains albumin. . . . Albuminous urine is the rule in yellow fever, a rare exception in remittent."

Ascoli,[1] Dubujadoux,[2] and others have noted the existence of peptonuria in association with the malarial paroxysm.

The occurrence of actual *acute nephritis* in connection with malria has also been recognized for many years, Chénouard,[3] Hertz,[4] Soldatov,[5] Dewalsche,[6] Verhaeghe,[7] Schmid,[8] Pepper,[9] Busey,[10] McLean,[11] DaCosta,[12] Wood,[13] Rosenheim,[14] Atkinson,[15] Bermann,[16] Stefanowicz,[17] Dods,[18] and many others noting this condition.

Throughout the Southern States, as testified to particularly by the admirable records of Joseph Jones,[19] the condition is not very infrequent. The grave and often fatal acute nephritis following hæmoglobinuric attacks is well known. These cases have been well studied by Bastianelli,[20] Kelsch, and Kiéner,[21] who have described at length the changes in the kidneys following the acute malaria. They believe that severe acute diffuse or glomerulo-nephritides may depend directly upon the malarial infection. They say that nephritis occurs in more than half the fatal cases. "It develops in the cases where the disease has a relatively long duration, and has been marked by symptoms of corpuscular dissolution, especially by hæmoglobinuria, from which we may conclude that it depends less upon the direct action of the malarial poison on the kidney than upon the irritation produced in the gland by the passage of the hæmoglobin and its derivatives."

Bignami,[22] in his valuable studies upon the anatomical alterations in acute malarial infections, noted the fact that the kidneys were, as a rule, but little affected. The glomeruli were markedly pigmented, the pigment granules sometimes seen within large colorless cells, sometimes apparently within the endothelium of the glomerulus; at times the most important lesions consisted of an exfoliation and degeneration of the

[1] Lav. d. Cong. d. Med. Int., 1892, Milano (1893), vol. v. p. 350.
[2] Arch. de Méd. et Pharm., Paris, 1892, p. 437.
[3] Rec. des Travaux de la Soc. Méd. du Depart. d'Indre-et-Loire, 1845, 2 s. 101.
[4] Op. cit
[5] St. Petersb. med. Woch., 1878, iii. 345
[6] Arch. Belges de Méd., Mil., 1859, xxiii. 20.
[7] Ibid., 1860, xxvi. 31.
[8] Deutsche Klinik, 1852, 442.
[9] THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, 1866, vol. li. pp. 405, 408.
[10] Ibid., 1873, vol. lxv. p. 123.
[11] Op. cit.
[12] Medical Record, New York, 1880, vol. xvii. p. 54.
[13] Ibid., 1888, vol. xxxiii. p. 320.
[14] Deutsch. med. Woch., 1886, xii. 752.
[15] Op. cit.
[16] Internat. klin. Rundschau, Wien, 1894, viii. 1844.
[17] Wien. klin. Woch., 1893, vi. 365.
[18] Edinb. Med. Journ., 1888, xxxiii. ii. 1890.
[19] Op. cit.
[20] Ann. di med. Nav., Anno 1896, ii.
[21] Maladies des pays chauds, 8°, Paris, 1889, and Arch. de phys. norm et path., Paris, 1882, 2 s. ix. 278, 458.
[22] Atti della R. acc. med. di Roma, Anno 1890, xvi. s. ii. v. 317.

epithelia lining the capsule, and only in algid pernicious fever did he find glomeruli with very slight albuminous exudates. Sometimes, however, marked and extensive alterations of the parenchyma were found, consisting of focal necrosis of the epithelia, especially those of the tubili contorti.

Barker,[1] out of four fatal cases of malarial fever, found in three instances that the kidneys showed but few changes, consisting of a slight pigmentation of the glomeruli, with albuminous exudates and casts, and a more or less swollen and degenerated condition of the epithelium of the convoluted tubules. The fourth instance was one of marked acute nephritis, which was probably of malarial origin, although complicated later in its course by a streptococcus infection (Case II. of our series).

In Anders'[2] 1780 cases there were but four instances of acute nephritis.

The frequency of the occurrence of *chronic nephritis* as a result of malarial fever is a point about which different opinions have been held.

Lenz[3] and Rosenstein[4] both believed malaria to be a frequent cause of chronic nephritis. Bartels[5] was also a strong upholder of this idea.

Hertz[6] asserts also that cases of acute nephritis in malaria may pass into chronic diffuse nephritis, a sequence which is recognized by many observers.

McLean[7] says: "I can confirm from personal observations Dr. Parke's remark that chronic Bright's disease is a consequence of ague. Many 'old Indians' who have suffered from malarial fevers die of this disease."

Kelsch and Kiéner[8] have described in detail the changes in chronic as well as in acute nephritis occurring in old "febricitants." They describe two main varieties of kidney as met with in chronic paludism: (1) the congested kidney; (2) the atrophic kidney.

1. The engorged kidneys are increased in size and weight, and of firm consistency. The surface is smooth, the color deep red, the congestion being particularly marked in the pyramids. Owing to the extensive congestion of the vessels interstitial hemorrhages or the escape of blood into the tubules may occur. There is a marked granular degeneration of the tubular epithelium, while desquamation is common. Hyaline casts may be found.

2. The atrophic kidneys are small, the surface is irregular, the capsule adherent, the consistency increased. The color is usually of a maroon or mahogany tinge, and often there is a blotchy appearance. Small

[1] Johns Hopkins Hospital Reports, 1895, vol. v. 230. [2] Op. cit.

[3] De diffusa nephritide chronica, præcipue respecto decursu morbi post intermittentem febrim, Inaug. diss, Gryphiae, 1865.

[4] Path. u. Therap. der Nierenkrankheiten, Berlin, 1870, 215.

[5] Ziemssen's Cyclopædia, Amer. edition, vol. xiv. 328. [6] Op. cit., p. 649.

[7] Reynolds' System of Medicine, vol. i.

[8] Maladies des pays chauds, 8°, Paris, 1889, 744, and Arch. de phys. norm. et path., 1882, ii. s. T. ix. 278.

cysts are common. Microscopically, alterations are to be found in the interstitial tissue as well as in the tubular epithelium. They note in conclusion that[1] "malarial nephritides have but little that is characteristic about them. We may again, however, note (1) the tendency toward hemorrhages in all forms and at all periods of the nephritis; (2) the frank character of the inflammation in contradistinction to the partly steatotic, partly sclerotic forms which gout and alcoholism give rise to so frequently with us; (3) the rarity, perhaps the absence, of amyloid degeneration, the ordinary expression of septicæmia of all sorts. Even in the cachexias the fatty and colloid degenerations of the kidneys are of a subinflammatory character and give rise to hemorrhages. They are sharply distinguishable from the lesions of the senile kidney by the wholly secondary importance of the vascular changes and notably by the absence of arterial atheroma."

Rowland[2] noted the frequency of chronic nephritis in the malarial regions of British Guiana.

Laveran[3] in his treatise states that "acute or chronic nephritis is a fairly common complication of paludism. The nephritis has sometimes the characters of an epithelial nephritis (the urine contains albumin in great quantity, anasarca occurs and becomes rapidly generalized) or that of interstitial nephritis or of mixed nephritis; this last form is believed the commonest."

Other observers have paid very little attention to malaria as a cause of chronic renal changes. Thus it is not mentioned in Senator's[4] work as an etiological factor in chronic nephritis.

In Anders'[5] 1780 cases, chronic nephritis was met with in but one instance.

Bignami,[6] in his admirable studies on the pathological changes in chronic malaria, lays but little stress on the changes in the kidneys.

Marchiafava and Bignami[7] have described *amyloid degeneration* of the kidneys following long and repeated febrile attacks. These have been associated with the clinical symptoms and anatomical lesions of a severe chronic nephritis. Beside the affection of the vessels of small and medium size and of the glomeruli, the authors found a considerable involvement of the walls of the renal tubules themselves.

Rem Picci,[8] of Rome, has recently published an interesting communication upon the renal lesions in malarial fever, which has come to the author's observation since the writing of this paper. He recognizes the

[1] Arch. de phys. norm. et path., 1882, s. ii. T. ix. 494.
[2] The British Guiana Medical Annual and Hospital Reports, Demerara, 1892, p. 41.
[3] Op. cit., p. 213.
[4] Die Erkrankungen der Nieren, Wien, 8°, 1896 (excerpt from Spec. Path. u. Therap., herausgegeben v. Nothnagel).
[5] Op. cit.
[6] Boll. d. R. acc. Med. d. Roma, 1893, xix. 186.
[7] Riforma Medica, Ann. vii. vol. i. 571.
[8] Policlinico, vol. v-M., 1898, 197.

fact that a malarial infection may be the cause not only of simple albuminuria, but of extensive renal changes, although such cases are rare. Malarial nephritis occurs more commonly in the fall than in the spring, and is particularly common in young individuals. It occurs in both the severe and the mild forms of the disease, and is no more frequent apparently in the former than in the latter.

The attack is usually mild and of favorable outcome, but it may be severe, and in some instances passes into a chronic form. The symptoms of nephritis appear not only during the malarial attack but sometimes develop after the disappearance of the acute symptoms of the infection. These cases Rem Picci has termed "post-malarial." Amyloid degeneration is occasionally met with. The exciting cause of malarial nephritis is believed by the author to be the elimination of the toxic products of the infection.

Thus, in summary it may be seen that the association of albuminuria with malarial fever has been generally recognized, but its frequency variously estimated, the general tendency being toward the idea that even in severe forms it is not so common but that the early appearance of albuminuria may be regarded as a valuable point in the differential diagnosis between this disease and yellow fever.

And while acute nephritis dependent upon malarial infection is well understood to occur, there are no existing statistics tending to show its relative frequency as compared with nephritis in other acute infections. The same may be said with regard to the more chronic renal changes.

It has, therefore, seemed advisable to us to analyze our cases of malarial fever occurring during the last eight years, with a view to determining the following points:

1. The frequency of albuminuria in malarial fever as compared with some other acute infections.
2. The frequency of acute nephritis in malarial fever.
3. The possible influence of malarial fever in the production of chronic renal changes.

Albuminuria.

During the past eight years 758 cases of malarial fever have been treated in the wards of the Johns Hopkins Hospital. In 691 of these cases there are records of examination of the urine:

Albumin was present in 321 instances	46.44 per cent.
There was no albumin in 370 instances	53.5 "

In the great majority of cases the albumin was present as a small trace. Casts of the urinary tubules were found in 121 cases—17.5 per cent.

The proportion of cases in which albuminuria was present varied materially, as might have been expected, according to the type of fever.

TABLE OF 691 CASES IN WHICH AN EXAMINATION OF THE URINE WAS RECORDED.

Tertian fever—344 cases:			
Albumin present in	132	cases—38.3	per cent.
No albumin "	212	" 61.6	"
Casts "	40	" 11.6	"
Quartan fever—8 cases:			
Albumin present in	4	cases—50 0	per cent.
No albumin "	4	" 50.0	"
Casts "	3	" 37.5	"
Regularly intermittent fevers (tertian and quartan)—352 cases:			
Albumin present in	136	cases—38.6	per cent.
No albumin "	216	" 61.3	"
Casts "	43	" 12.2	"
Æstivo-autumnal fever—283 cases:			
Albumin present in	165	cases—58.3	per cent.
No albumin "	118	" 41.6	"
Casts "	70	" 24.7	"
Combined infection (tertian and æstivo-autumnal)—26 cases:			
Albumin present in	11	cases—42.3	per cent.
No albumin "	15	" 57 6	"
Casts "	7	" 26.9	"
Cases of uncertain type—30 cases:			
Albumin present in	9	cases—30.0	per cent.
No albumin "	21	" 70.0	"
Casts "	1	" 3 3	"

It thus becomes evident that albuminuria has occurred in nearly one-half of all the cases of malarial fever treated in the hospital. In the regularly intermittent fevers, tertian and quartan, the proportion of cases of albuminuria was 38.6 per cent., while in the æstivo-autumnal infections, the majority of all cases, 58.3 per cent. showed albumin in the urine. The large percentage in æstivo-autumnal fever is not remarkable when one considers the many other clinical evidences of the greater malignancy of infections with the æstivo-autumnal parasite.

Our statistics show, however, a rather strikingly large proportion of instances of albuminuria in all types. They can scarcely be compared to those of Anders, who has used the qualifying term " marked." The percentage is, however, five times as large as that of Atkinson,[1] who found albuminuria in 9 per cent. of 121 cases.

Particularly conspicuous is the high percentage of albuminuria among the cases of æstivo-autumnal fever. It is in the more severe infections with this variety of parasite that the so-called remittent and pernicious fevers most commonly occur, and in these more severe attacks it would be but fair to assume that the percentage of cases showing albumin would be yet larger than that shown by our figures. And yet it is in just these cases that, at times, the question of a differential diagnosis between yellow fever and malarial fever is believed by some authors to hang upon the presence or absence of albumin in the urine.

[1] Op. cit.

It may be interesting to compare the frequency with which we have found albumin in the urine of patients with malarial fever with our own statistics and those of others with relation to certain other of the acute infectious diseases.

Typhoid Fever. Here we may use our own statistics. In 389 cases of typhoid fever Hewetson and Osler[1] observed albumin in 303 instances, or 78 per cent., and casts in 164, or 42.2 per cent.

Scarlet Fever. The frequency of albuminuria in scarlet fever has been variously estimated. Miller,[2] Patrick,[3] Steiner,[4] and Gubler,[5] as well as Lecorché and Talamon,[6] believe that albuminuria is practically always present during the febrile period of the disease. Sée[7] estimated that it was present in more than one-half the cases, Haidenheim[8] in 80 per cent. Cadet de Gassicourt[9] found albumin in 21 out of 65 cases, but believes these figures to be too high. Barthez and Sanné[10] believe it to be relatively rare, while Vogel[11] found it in two instances out of 50 or 60 cases, and Thompson[12] in 40 out of 112 instances.

The later albuminuria, that occurring during convalescence, was observed in 30 per cent. of the cases of Cadet de Gassicourt, and in 55 out of 112 cases studied by Thompson.

Caiger[13] found albuminuria in but 7.69 per cent. of 4015 cases in the London Fever Hospital; he asserts that the frequency of this condition is much less than is generally supposed. He omits, however, from his statistics those cases in which "but a faint and transient cloud of albumin was noted for less than three days."

My friend, Dr. McCollom, has very kindly sent me the results of the examination of the urine in 100 cases of scarlet fever in the Boston City Hospital:

1/4 to 1/8 per cent of albumin	4 cases.
1/10 per cent. " "	1 case.
Large trace " "	1 "
Trace " "	4 cases.
Slight trace " "	14 "
Very slight trace " "	15 "
Slightest possible trace of albumin	49 "
No albumin	12 "
	100 cases.

[1] Hewetson: Johns Hopkins Hospital Reports, 1894, iv. 113. Osler: Ibid., 1895, v. 281.
[2] Lancet, 1849, ii. 1, 57, 113, 197, 281, 524, 685.
[3] Cited by Guinon, art. Scarlatina, in Traité de Méd., Charcot, Bouchard, Brissaud, 8°, Paris, 1892, T. ii.
[4] Compendium der Kinderkrankheiten, 3d ed., 8°, Leipzig, 1878.
[5] Dict. encycl. des sc. méd., Paris, 1869, ii. 476.
[6] Cited by Guinon, op. cit.
[7] Le Moniteur des Hôp., 1858, 659.
[8] Cited by Barthez and Sanné.
[9] France Méd., Paris, 1881, ii. 388, 400.
[10] Traité clin. et prat. des maladies des enfants, 3me éd., Paris, 1891, 124.
[11] Quoted by Barthez and Sanné.
[12] Med. Chir. Transactions, 1887.
[13] Article, Scarlet Fever, in A System of Medicine, etc., edited by T. Clifford Allbutt, London, 1897, vol. ii. 151.

Diphtheria. The frequency of albuminuria in diphtheria is also variously estimated. Sée[1] believed it was present in one-third or in one-half of all cases; Maugin and Bergeron[2] assert that it occurs in the majority of instances. Bouchut and Empis[3] estimate its frequency at 66.7 per cent., as does also Ebert.[4] Smith[5] found it present in 24 out 62 cases, or 38.7 per cent., but believes that the proportion is probably greater, inasmuch as albumin was often missed, owing to the transient character of the symptoms. Sanné[6] found albumin in 224 out of 400 cases, or 54.5 per cent.

By far the most satisfactory statistics are those of McCollom.[7] Out of 633 cases of diphtheria albumin was present in 57.7 per cent. and absent in 42.3 per cent.

If we compare our statistics of malarial fever with those of typhoid fever, we find that malaria stands well behind the former affection in the frequency with which albuminuria is observed.

The figures show:

	Malarial fever.	Typhoid fever.
Percentage of cases of albuminuria	46.4	78
Percentage of the cases in which tube-casts were found	17.5	42.2

This is not remarkable when one considers through how long a period the kidneys of a patient with typhoid are subjected to the influence of the toxic products of the infection, as well as to the continued high temperature.

If, however, one compare the percentages in the more severe æstivo-autumnal fevers, the figures approach one another more closely.

	Æstivo-autumnal fever.	Typhoid fever.
Percentage of cases of albuminuria	58.3	78
Percentage of cases in which casts were found . .	24.7	42.2

Scarlet Fever. From a consideration of the varying estimates above mentioned, it would appear that albumin is in all probability present in at least one-half the cases of scarlet fever. McCollom's figures indicate a still higher percentage. It is, perhaps, possible that in a certain proportion of the 49 per cent. of cases where the "slightest possible trace of albumin" was found, the minute quantity would have passed unobserved with ordinary routine methods of urine examination.

It may be fair to compare Caiger's estimate, where those cases showing "a faint and transient cloud lasting less than three days" were omitted, with our cases in which casts were found.

Such a table shows: *Caiger's statistics of the frequency of albuminuria in scarlet fever*, 7.69 per cent.

[1] Op. cit.
[2] Moniteur des Hôpitaux, Paris, 1858, vi. 1035, 1043, 1051, 1064.
[3] Gaz. des Hôp., 1858, 524.
[4] Cited by Oertel, Ziemssen's Cyclopædia, American edition, i. 603.
[5] Keating's Cyclopædia of Diseases of Children, i. 626.
[6] Traité de la diphthérie, 8°, Paris, 1877, pp. 128 et seq.
[7] Med. and Surg. Reports, Boston City Hospital, Ninth Series, Boston, 1898, p. 27.

Percentage of our own cases of malarial fever in which albumin and casts were present, 17.5 per cent.

One can, however, form few conclusions from this comparison excepting that in malarial fever, at least in æstivo-autumnal fever, the percentage of cases of albuminuria is not very far below that in scarlet fever.

Diphtheria. Assuming that McCollom's figures form a fair basis for comparison we find:

	Malarial fever.	Diphtheria.
Percentage of cases of albuminuria	46.4	57.3

And this slight discrepancy in favor of diphtheria disappears when we consider æstivo-autumnal fever separately.

	Æstivo-autumnal fever.	Diphtheria.
Percentage of cases of albuminuria	58.3	57.3

Albuminuria, then, is more common in such notoriously severe acute infections as typhoid fever, scarlet fever, and diphtheria than in malaria; the difference, however, is by no means great. While occurring in only 38.6 per cent. of the regularly intermittent fevers, the frequency of albuminuria in æstivo-autumnal fever is probably fully as great as in diphtheria, and by no means so very much less than in typhoid and scarlet fevers.

Yellow Fever. While the occurrence of albumin in the urine in malarial fever cannot be compared in frequency with that observed in yellow fever, and while the amount when present is probably usually smaller, the fact that a majority of all instances of æstivo-autumnal fever in the climate of Baltimore, cases lasting but a short time and treated almost immediately by quinine, showed albuminuria, is strong presumptive evidence in favor of the idea that a considerably larger percentage of the severe pernicious cases which are most likely to be confounded with yellow fever must show this symptom. This would suggest caution in placing too great reliance upon the presence of albumin as evidence of the existence of yellow fever in a suspicious case.

It may be asked whether our figures represent the condition in the first days of an æstivo-autumnal infection. I think it may fairly be asserted that they do.

There were 96 cases of æstivo-autumnal fever in which the urine was examined within a week after the first symptoms of the infection. In the urine in these cases albumin was present in 57, or 59.3 per cent.; casts were present in 28 or 29.1 per cent.

Acute Nephritis.

Among 1832 cases of malarial fever occurring in the Johns Hopkins Hospital and Dispensary we have observed 26 instances of acute nephritis. In three of these cases there is room for possible doubt as to whether the

nephritis may not have preceded the malarial infection, though in none is this believed to have been the case. Of all these cases there were:

Instances of tertian fever	7
" æstivo-autumnal fever	16
" quartan fever	1
" combined infection (tertian and æstivo-autumnal)	1
" uncertain type	1
Total	26

These were all typical cases of acute nephritis, the majority showing œdema, while abundant albumin and numerous casts as well as blood corpuscles and epithelium were found in the urine.

In fourteen instances the complication occurred in the first attack of malaria; in eleven instances the patient had suffered from one or more previous infections; in one there was no history obtainable.

In thirteen instances the complication ended in recovery (Cases III., IV., V., VII., IX., X., XI., XII., XIII., XVIII., XIX., XXII., XXIV.). In Cases III., IV., and V. there was still a trace of albumin present on discharge. In Cases XXII. and XXIV., a dispensary patient, but one examination of the urine is recorded. In all instances, however, the general condition warranted the conclusion that the patients were on the road to definite recovery.

In four instances the complication ended in death (Cases I., II., XV., XVI.).

In nine instances the result was doubtful (Cases VI., VIII., XIV., XVII., XX., XXI., XXIII., XXV., XXVI.).

Fatal Cases. The four fatal cases include the three instances in which some doubt may be held as to the true malarial nature of the nephritis, Cases II., XV., and XVI.

In Case II. there had been a history of œdema and bloody urine for several months, while regular chills had been noted but three weeks. The patient, however, had throughout this period been working in an extremely malarious district at the most dangerous time of the year. It is improbable that his malaria was acquired in December; far more likely that the infection occurred earlier in the season. He was a dull, stupid negro, and experience has shown us that a clear history of the time of onset of a malarial infection is often very difficult to obtain in such instances.

In Case XV. the clinical observation was unsatisfactory. Death occurred in coma, the breath having a urinous odor and the urine containing 0.25 per cent. of albumin; the illness apparently began sharply with a malarial infection two weeks before. The record of the examination of the urinary sediment, however, was unsatisfactory.

Case XVI. was one of characteristic acute nephritis which took on a chronic course, resulting fatally seven months after the onset. The patient had been living in a malarious district, and had had chills and

fever for a month and a half before entry, associated with anasarca, ascites, and evidences of acute nephritis. Œdema of the feet, however, was said to have been noticed for a month before the onset of the chills. In this case there is also a history of scarlet fever (without dropsy) six years before. It is our belief that in the absence of other causes, all three of these instances were true malarial nephritis. It is but fair, however, to point to the possibility that another view of the matter may be taken.

In Cases XV. and XVI. autopsy was not permitted.

Case I. was an instance of pernicious fever, in which death was due to the acute infection rather than to the nephritis. In Cases I. and II. the anatomical changes have been excellently described by Dr. Barker.

Histories of four fatal cases:

Case I. *Pernicious malarial fever; æstivo-autumnal infection; acute nephritis; death; autopsy.*—No. 1769. J. B.; male; aged thirty-four years; entered the hospital on September 9, 1890, complaining of fever, weakness, headache. The patient has been sleeping on the ground in a very malarious district. For three days he has complained of great weakness and continuous vomiting. No further history is obtainable.

Physical Examination. The patient is very weak and tremulous; tongue coated; thorax negative; spleen palpable; pulse 104; temperature 101°.

Blood. Æstivo-autumnal parasites; hyaline amœboid bodies in great numbers.

September 11th. The temperature rose this evening to 102°. No great change in the condition.

12th. The patient seems better to-day; vomiting is less frequent.

Treatment. Quinine, .325 (gr. v) three times a day.

On the 13th and 14th there was no vomiting, but the patient complained of great weakness. On the evening of the 15th the patient passed into a peculiar condition. He became drowsy and dull, and was aroused only with great difficulty. He was restless and uneasy, turning and tossing the clothes about. Occasional vomiting. Throughout the night of the 15th the patient was restless and there was hiccough. The temperature, which had been normal since the 12th, fell to a subnormal point. The vomitus during the night was tinged with blood. On the morning of the 16th the patient was catheterized, 1500 c.c. of urine being obtained. The examination showed a specific gravity of 1010; a moderate quantity of albumin. The sediment contained many casts, chiefly granular and hyaline, though partly epithelial casts were not uncommon.

At four o'clock in the afternoon the temperature had fallen to 96°. The patient was very restless, cold, and dusky; growing steadily weaker, and finally unconscious, he died at 8.45 P.M.

Autopsy (Dr. Councilman). Diagnosis: Pernicious malaria; acute splenic tumor; malarial pigmentation of spleen and liver; hypostatic congestion of the lungs. . . . The kidneys were large and swollen, surface mottled; capsules adherent in places. On section the consistency is firm. The Malpighian tufts are prominent and congested. The medullary rays are pale, and between them the lines of vessels are

deeply reddened. No areas of opacity are visible. The cortex is distinctly, though slightly, pallid.

Microscopical Examination (Dr. Barker[1]). On microscopical examination all the bloodvessels of the kidneys were found to be dilated, the veins of the pyramids being especially wide. There is irregular dilatation of the glomerular capillaries. Comparatively few parasites are present in the kidneys, although some distinct forms are visible within the veins of the capillaries. A number of phagocytic cells can be seen, intravascular phagocytes and endothelial cells. The capsules of some of the glomeruli have undergone fibrous thickening. In places the capsular endothelium is proliferated. The endothelium of the convoluted tubules is swollen and granular and there are numerous hyaline casts to be seen in the small collecting tubules. In the pyramids hæmoglobin casts can be made out.

In this instance the nephritis, as in most cases of typhoid fever, played but a small part in the clinical picture of the disease. Possibly, had the patient recovered from the acute infection, or had life been further prolonged, clinical evidence of the renal changes might have appeared.

CASE II. *Malarial fever; double tertian infection; subacute nephritis; death three and one-half months after onset.*—No. 5421. L. W.; male; colored; aged twenty-three years; admitted January 9, 1893. Family and personal history negative. Gonorrhœa nine years ago. Three months ago while working in a very malarious district began to suffer from frequent micturition, general œdema, and bloody urine. For three weeks has had regular tertian chills.

Physical Examination. Marked general œdema; ascites; no cardiac hypertrophy; pulse-tension not increased; spleen not palpable (distended abdomen).

Blood. The blood was not examined until after death; it then showed an extremely severe double tertian infection.

Urine. Dark amber, clear, acid; 1017; large amount of albumin. Sediment: Hyaline, granular, and epithelial casts; many epithelial cells.

There were daily febrile paroxysms, the nature of which was not appreciated during life.

The urine ranged in quantity at first between 500 and 1000 c.c., diminishing gradually before death. For the last three days it amounted to but 250 to 350 c.c. The patient became enormously œdematous, and grew more and more anæmic. He was dull and stupid, but restless and uneasy. On January 26, 1893, he died.

The patient was treated throughout as a case of nephritis. A milk diet was ordered and frequent hot baths. Diuretin and digitalis were given internally.

Autopsy (Dr. Councilman). "Anatomical diagnosis: Acute malarial fever; double tertian infection; general streptococcus infection; subacute Bright's disease; malarial pigmentation of the organs; chronic passive congestion; general anasarca; infarctions of kidneys; erysipelas."

"*The blood,* examined fresh from the peripheral veins and various internal organs, showed enormous numbers of malarial parasites, most of them nearly full-grown, others only half-grown (tertian type), many of them enclosed within the protoplasm of large mononuclear leucocytes.

"The kidneys together weigh 400 grammes. They are both alike in

[1] Johns Hopkins Hospital Reports, v. 234.

size and general appearance. On the surfaces of each a few small, fresh infarctions with hemorrhagic margins are visible. The capsules strip off easily. The general color of the external surfaces of the kidneys beneath the capsules is yellowish-brown, marked by scattered opaque darker areas, and here and there by minute hemorrhages. The whole kidney has a rather soft œdematous feel. On section the cortex has a yellowish appearance and is rather translucent; pyramids reddened, contrasting sharply with the lighter colored cortex. In some parts of the cortex the striæ are well marked, in others they are less apparent or invisible. Average width of cortex 1 cm. A small amount of fluid exudes from the cortical substance on pressure. The glomeruli are indistinct.

"Frozen sections of the kidney show a very little fat in fine droplets in the glomeruli. The epithelial cells of the tubules in the labyrinth are much swollen and are filled with fine albuminous granules and hyaline droplets. Many of the tubules are dilated and are lined by low epithelium. Casts are numerous in sections and in urine collected from the bladder; coagulated albumin is visible in the capsular spaces, in frozen sections made from a bit of kidney previously fixed in boiling water. The capsular epithelium is swollen and evidently proliferated."

The kidneys were carefully studied by Dr. Barker.[1]

"*The Kidney.* An examination of many glomeruli shows considerable variation in the size of the capsular spaces. While in some instances the glomerulus almost completely fills out Bowman's capsule, the space being a mere chink, in others the latter is equal in size to one-third of the whole capsule. The space is not always empty, but may contain coagulated albumin, red blood-corpuscles and shadows, or a few mononuclear cells (desquamated epithelium). The fibrous capsules are not thickened except occasionally where an atrophied glomerulus is visible. Frequently just outside the capsule of Bowman a narrow clear space can be made out, and this may contain a few cells, chiefly polynuclear leucocytes, or even be crowded with them. In many of the capsules the capsular epithelium is evidently proliferated, the whole inside of the space being lined by nuclei with intensely staining chromatin. The glomerular capillaries vary in their size and contents; some of them are empty, others are distended. Occasionally one is seen to be plugged with streptococci. The number of white corpuscles within the glomerular capillaries also varies; they are very irregularly distributed; in some glomeruli scarcely any are present; in others, one, two, or more of the glomerular capillaries may be packed full of polynuclear leucocytes. In a section stained in methylene blue a capillary is visible plugged at one point with streptococci and crowded throughout the rest of its extent with leucocytes, with polymorphous nuclei, reminding one forcibly of the appearance of the capillary glass tubes in an experiment in positive chemotaxis. On the other hand, masses of cocci may be seen with no neighboring leucocytic accumulation. The nuclei of the polynuclear leucocytes vary in appearance: some stain sharply and take on the ordinary forms; others stain less sharply, have a blurred look, and assume bizarre shapes. The protoplasm of the polynuclear leucocytes frequently contains granules or minute clumps of granules of malarial

[1] Johns Hopkins Hospital Reports, vol. v. p. 257.

pigment, occasionally a well-formed parasite or short chains of cocci. There is some malarial pigment in the glomeruli contained within the protoplasm of mononuclear cells. The majority of the malarial parasites in the glomerular capillaries are outside nucleated cells. Here and there in specimens stained with aqueous magenta a giant spindle-shaped nucleus is visible. The lumina of the convoluted tubules are for the most part wide and are lined with rather low cubical epithelium. There are a few areas of dilated tubules, in which the lining epithelium is flattened so as to resemble endothelium. The nuclei of the epithelial cells, as a rule, stain normally, although in some swollen cells they stain feebly, and in some tubules the nuclei are shrunken and the chromatin stains more intensely than normally.

"Many of the convoluted tubules and collecting tubules contain hyaline casts; and hyaline droplets are visible within the swollen lining epithelial cells. These droplets, both the finer and the coarser, and the upper portions of the hyaline casts, stain intensely in Weigert's fibrin stain. Occasionally desquamated epithelial cells and a few red blood-corpuscles and round yellowish striped urinary concrements are to be seen within the lumina of the tubes.

"The intertubular capillaries contain enormous numbers of streptococci (methylene-blue, Weigert's fibrin stain). Many of them are dilated and completely plugged with cocci, and sometimes chains of cocci are visible in narrow pericapillary spaces. As in the glomerular vessels, some of the intertubular capillaries are crowded with leucocytes. Some of the small veins in the cortex are actually thrombosed with masses of streptococci, large numbers of malarial parasites, white corpuscles (some of which are necrotic), and pigment clumps. No bacteria other than streptococci are present anywhere in the kidney.

"In the interstitial tissue of the kidney there is a slight but evident increase in the number of the cells of the lymphoid type. There are small nodal masses of smaller and larger round cells, usually with but little perinuclear protoplasm, many of them with fragmented nuclei. These minute nodes may contain beside lymphoid cells single polynuclear leucocytes or epithelioid cells.

"Sections of the kidney treated with ferrocyanide of potassium and hydrochloric acid show an almost entire absence of cells containing hæmosiderin. Here and there, however, a little is visible within the protoplasm of the endothelium of the vessels.

"The infarcted areas of the kidney present the lesions ordinarily seen under these circumstances—anæmic necrosis and neighboring reaction. The whole of the necrotic area—glomeruli, tubules, bloodvessels, interstitial tissue—refuses to stain in the ordinary nuclear dyes, and has an increased affinity for eosin. The only nuclei which stain are those of polynuclear leucocytes which have invaded the interstitial tissue everywhere, and are accumulated in large numbers at the margins of the infarcted areas, and in the neighboring dilated bloodvessels. There is extensive nuclear fragmentation in these polynuclear leucocytes, and the most varied distortion-processes (*abschnurungsvorgänge*) of their nuclei are visible. Many of the bloodvessels at the apices and in the peripheries of these infarctions are thrombosed with streptococci, enormous numbers of malarial organisms—over one hundred of which were counted inside the lumen of one vessel—and white cells. Small bits of the kidney hardened in Flemming's stronger solution and stained with aqueous

magenta yield very instructive sections. Fine fat droplets are visible in the glomeruli and in the epithelium lining the capsular spaces. The convoluted tubules are not extensively fatty; some are entirely free from fat droplets, others show numerous smaller and larger droplets, especially at the proximal ends of the lining epithelial cells. Fine fat droplets are also visible in the protoplasm of some of the leucocytes in the vessels, and also in the smooth muscle fibres of the arteries. The desquamated epithelial cells within the lumina of the tubules contain numerous rather coarse fat droplets. The cells of the convoluted tubules in sections prepared in this way are seen to be finely granular, and the hyaline degeneration of the protoplasm is well shown. Many of them contain large vacuole-like spaces which sometimes displace the nuclei. In some of the tubes free red blood-corpuscles, polynuclear leucocytes, and malarial organisms are visible. The last named are sometimes free or lie on red blood-corpuscles, sometimes they are enclosed within cells. They are to be seen in both polynuclear and mononuclear cells within the lumina of the convoluted tubules. In one tubule, beside numerous red blood-corpuscles and shadows, four free well-formed malarial organisms and a mononuclear cell containing within its protoplasm five malarial organisms of the same stage of development can be made out. Pictures such as these were seen too often to be accounted for by technical accidents. Occasionally red corpuscles, malarial parasites, and white cells are visible within the glomerular capsular spaces."

The time at which the streptococcus infection came on is not clear.

CASE XVI. *Malarial fever; tertian infection; nephritis; uræmia; coma; death; no autopsy.*—No. 17,406. P. J., female, aged fourteen years; admitted September 26, 1896. The patient had chills and fever during six months last year. No history of other infectious diseases. Eleven days ago she began to suffer from pains in neck and legs, dyspnœa on exertion, fever, and cold sensations.

Physical Examination. The face has a pasty white color; lips pale; tongue coated. The patient is very apathetic; somewhat delirious; spleen not palpable; no œdema; breath has a urinous odor.

Blood. Extracellular tertian bodies. Leucocytosis of 21,000.

Urine. Passed involuntarily and lost.

Temperature. Subnormal.

On the 27th the patient became comatose.

Urine. Catheterized specimen; pale yellow, opaque; 1008; albumin 0.25 per cent. The sediment contains considerable pus. No casts or blood to be seen.

Despite hypodermic injections of quinine and stimulation, the patient died comatose on the 27th. Autopsy was not allowed.

This case is unsatisfactorily recorded. The author was absent at the time, but Dr. Camac, who saw the case, tells me that there is little doubt that the death was from uræmia. As to the causal influence of the malaria, there must be some question.

CASE XVI. *Malarial fever; æstivo-autumnal infection. Acute nephritis, becoming chronic; death.*—No. 17,621. I. A., female, aged fourteen years; entered October 17, 1896. Family history negative. The patient had measles and whooping-cough as a child; scarlet fever six years ago.

Has always been well and strong. She lives in a most malarious district. Two and a half months ago she began to notice slight œdema of feet and puffiness of eyes. A month and a half ago began to have chills and fever. At this time the swelling increased considerably, involving the genitalia and abdomen and becoming very troublesome. The urine was reduced in quantity and red. There was marked pallor. The chills disappeared under treatment; she had but seven or eight in all, and thinks she has quite recovered from the malaria.

Physical Examination. Marked pallor; general œdema and ascites. Heart's apex in fourth space, 8 cm. from median line. Second aortic sound markedly accentuated.

Blood. Half-grown tertian parasites.

Urine. Pale; acid; 1012; albumin, 0.5 per cent. Sediment, abundant; epithelial cells, small, round, and larger flat; hyaline, finely and coarsely granular casts; blood casts; pus cells; granular matter.

Under quinine the parasites rapidly disappeared. The temperature was normal throughout. The urine, however, was always reduced in quantity and the œdema never cleared up. The pulse throughout was of high tension; second aortic sound markedly accentuated. Uræmic symptoms, headache, vomiting, and eventually coma existed for five months, death occurring on March 20th. The albumin at times was present in as large quantities as 0.7 per cent. The patient was kept for the greater part of the time on a milk diet. Various diuretics and iron were given internally. Hot water and hot-air baths, with pilocarpine internally, were administered with only temporary effect. No autopsy was permitted.

Cases with uncertain result. In nine instances, Cases VI., VIII., XIV., XVII., XX., XXI., XXIII., XXV., and XXVI., the final outcome of the nephritis is not perfectly clear, though in the majority recovery probably occurred.

Cases XXIII., XXV., and XXVI. were observed in the dispensary, and were seen on but one occasion.

Case VI. was an instance of mild acute hemorrhagic nephritis occurring in æstivo-autumnal fever. The patient left a week after admission, feeling perfectly well, the urine containing, however, at the time of discharge, a trace of albumin, while the sediment showed occasional hyaline and granular casts and red blood-corpuscles. There was no cardiac hypertrophy; no increase in the blood tension; never any œdema.

Case XIV. was that of a man, aged forty-one years, who had suffered off and on for a month with daily chills, and for ten days with œdema of the face and extremities. The urine showed the characteristics of a mild acute hemorrhagic nephritis. Considerable improvement in the general condition occurred under quinine, but the patient had a carbuncle upon the back of the neck, and four days after entry left the hospital against advice, dreading an advised operation.

In cases XVIII., XX., and XXI., especially in the two former, there is some possibility that the process may have become chronic. These cases will be considered later.

ANALYSIS OF 26 CASES OF ACUTE MALARIAL NEPHRITIS.

From 1 to 10 years of age	2 cases.
" 10 " 20 " "	4 "
" 20 " 30 " "	9 "
" 30 " 40 " "	6 "
" 40 " 50 " "	5 "
Total	26 cases.

The figures in this table run practically parallel to those in our former statistics as to the relative frequency of malarial fever, with the exception of the slightly greater percentage of cases of nephritis between the ages of forty and fifty years. The small percentage of cases under ten years of age is, perhaps, explained by the absence of a children's ward in the hospital.

Sex:

Of the 26 cases there were males	17—65.3 per cent.
" " " females	9—34.6 "

Race:

20 of the 26 cases were in white patients	76.9 "
6 " " " negro "	23.0 "

These latter figures are striking. Of 1832 cases of malarial fever, but 82 (4.4 per cent.) were in colored patients; and yet of these few patients 6 (7.3 per cent.) developed acute nephritis, against 20 (1.1 per cent.) in 1750 whites.

These figures are quite in keeping with the clinical fact which we have learned to recognize, in this hospital at least, namely, that the colored race is much more susceptible to renal disease than the whites.

(To be continued.)

A CASE OF TWO ISOLATED CARCINOMATOUS GASTRIC ULCERS.[1]

APPARENT RECOVERY AFTER EXPLORATORY CŒLIOTOMY; DEATH EIGHTEEN MONTHS LATER, FOLLOWING A SECOND OPERATION; HYPERCHLORHYDRIA TO THE END.

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IT is accepted that in approximately 5 to 8 per cent. of all cases of cancer of the stomach the growth has had origin about the cicatrix of a previously existing simple ulcer or in the margin of one still open.[2]

[1] Read at the thirteenth session of the Association of American Physicians, Washington, D. C., May 3, 1898.

[2] The carcinomatous degeneration of the margin of the cicatrix of an ulcer was first pointed out by Brinton. Rosenheim considers that from 5 to 8 per cent. of gastric ulcers become carcinomatous. Zeitschrift f. klin. Med., Bd. xvii., and Berl. klin. Woch., 1889, p. 47.

Cases, however, of complete transformation of an open ulcer into carcinoma, forming the *ulcus carcinomatosum*, are much more rare,[1] and are of no little interest and importance, representing, as they do, a group, the diagnosis of individual cases of which is often most difficult.

It is not to the review of the literature of these that attention is now directed, but to the consideration of a case recently encountered, about which several curious features are centred, that cause it to stand somewhat apart and render it worthy of isolated report.

The points of special interest are that eighteen months before the patient came under the writer's observation the ailment was regarded as one of carcinoma of the stomach by the surgeon, Dr. Keen, who at that time did an exploratory cœliotomy. The body of the stomach was then apparently so much involved in the presumed cancerous process that the idea of a gastro-enterostomy, previously entertained, was abandoned. What appeared to be two small glands in the omentum were removed, and one was found to be a metastatic cancerous nodule. A seeming return to perfect health followed the section, with a gain in weight at least ten pounds in excess of that ever weighed before. Dr. Keen reported the case nine months later as to all appearances completely cured. The symptoms subsequently recurred. Through the kindness of Dr. Keen, the case then, after a lapse of eighteen months, came under the writer's observation. The indications were now rather of chronic ulcer, and but for the knowledge of the removed cancerous nodule it would in all probability have been so diagnosticated. No tumor existed; the stomach was normally placed and not dilated; the secretory function was normal; motility was lowered; the patient could eat and digest a hearty meal without pain or discomfort. Digestive leucocytosis was present, and pathological leucocytosis, as concerns absolute increase in number of leucocytes, absent. The skin was of cachectic hue, but the patient had lost only a minor part of the large amount of weight gained after operation, and his physical condition was relatively remarkably good. A second exploratory cœliotomy disclosed what appeared to be an entirely healthy stomach save at one point, at which was discovered a large ulcer. The patient died as a result of septic peritonitis. The necropsy showed two large distinctly isolated and widely separated carcinomatous ulcers, while the remainder of the stomach except the pylorus, which was the seat of simple fibrous thickening, was perfectly healthy.

The patient, J. H. K., was a physician, aged fifty-two years. He had never had syphilis. The family history was fair; parents and grandparents had all died of old age, with the single exception of his mother, who had succumbed to presumptive gastric cancer when sixty-

[1] According to Hemmeter (Medical Record, September 11, 1897), who has recently reviewed this subject, about twenty-eight are on record.

five years old. When in his best condition his body-weight was between 155 and 165. This last weight had, previous to the first operation, never been exceeded. He had typhoid fever at the age of twenty-two years. Diarrhœa of about a year's duration succeeded. Otherwise he had been free from illness until within the past six years; although for nearly twenty years, as was elicited on careful inquiry, he had had more or less neurotic disturbance of digestion, apparently of the nature of hyperchlorhydria, occurring chiefly when he was overworked or subjected to excessive mental strain. He was of a nervous disposition and of easily disturbed mental equipose. A hard-working country practitioner, his habits of living were irregular as concerned eating and sleeping. In December, 1890, his mother, to whom he was much attached, died. She had had symptoms of gastric cancer, the duration of which ailment was about a year. Her illness and subsequent death worried him a great deal. He lost appetite and fell off in weight and strength, and was much constipated. His ailment was regarded as a mere nervous indisposition, for which a change of air was suggested. After a few months spent in California he gained in strength and weight, and remained in fair condition for over a year. But anorexia, constipation, and a tendency to heartburn and pyrosis continued. Actual pain was apparently never present. There was, however, a sensation of distress and uneasiness, which appeared several hours after a meal, associated with heartburn. These sensations were felt in the epigastrium, and often extended posteriorly to a point immediately below the inferior angle of the right scapula. This is as he described his symptoms to me. In Dr. Keen's notes, taken just before the first operation, it is stated that he suffered from much gastric distress six years before, and "a sense of weight and pressure extending through the body from the pit of the stomach to the back at a point to the right of the spine on a level with the lower angle of the scapula." He finally abandoned practice almost entirely, devoting himself to travel. His health was now on the whole fair, until the latter part of February, 1896, two-and-a-half months before he came under Dr. Keen's observation. Then he had an attack of influenza. A sudden and profuse gastric hemorrhage occurred early in March, 1896. About a quart of blood was said to have been vomited, and a pint afterward escaped by the bowel. No aggravation of the gastric symptoms had preceded the hemorrhage, and the severe hemorrhage did not recur. But subsequently to the time of operation (five weeks) he vomited very frequently a dark-looking fluid, recognized by his attendant, Dr. Wright, of Erie, as altered blood. During the greater part of this time he was nourished almost solely by the bowel. From his former weight of 160 pounds he had fallen, during the six years, to about 130 pounds. As a result of the hemorrhage and the five weeks exclusive bowel-feeding, there was a further loss of about fifteen pounds. He was first seen by Dr. Keen, May 13, 1896. A history of the case, very much as is stated, was elicited by Dr. Keen, who also noted that his color was decidedly sallow, and that "he appeared as one who had lost much strength and was quite sick." A physical examination by Dr. Keen[1] disclosed no disease in the organs of the chest or in the kidney. No abdominal tumor could be made out, but "a distinct sense of marked resistance

[1] See Dr. Keen's paper, "Tuberculosis or Carcinoma of the Stomach; Exploratory Cœliotomy Subsequent Apparently Complete Cure." Annals of Surgery, June, 1897.

was apparent in the epigastrium." The debilitated condition of the patient rendered it unwise, in Dr. Keen's opinion, to make a study of the condition of the stomach by the employment of the tube. Nothing is therefore known of the condition of the secretory function at this time. An exploratory cœliotomy was now determined on by Dr. Keen, "the expectation being that a cancer of the stomach would be revealed." To quote from Dr. Keen's report, just referred to:

"The operation was done May 22, 1896. There were present during the operation, Professor J. H. Etheridge, of Chicago; Dr. W. A. Edwards, of San Diego, Cal., Dr. J. J. Buchanan, of Pittsburg, and Drs. J. M. Baldy, William J. Taylor, and George W. Spencer, of Philadelphia. A vertical incision was made through the middle of the left rectus. The stomach immediately presented and was drawn out. The site of the disease was found to extend toward the cardiac extremity of the stomach, and, in order to reach it fully, the incision was extended upward to the border of the ribs. Even then it was only possible to bring about half of the stomach into the abdominal opening and almost none of the upper end. By holding up the abdominal walls, however, a view of nearly all the stomach was obtained. From the cardiac end toward the pylorus the disease extended as an infiltrating growth, both anteriorly and posteriorly, over an area extending over nearly the whole of the stomach. It did not reach quite to the pylorus. The mass was nodulated, hard, and thick, and every one present believed that it was cancerous. It was so extensive that no room was left for a gastro-enterostomy, so the abdomen was closed. Before doing so two enlarged glands in the great omentum were noted, and around one of these a ligature was cast, after which it was removed for microscopic examination.

"The patient made an uninterrupted recovery. Shortly after the operation he began to take liquid, and then semi-solid food, and soon afterward solid food, and left the hospital about three weeks after the operation, having not only recovered from the operation, but being, apparently, on the high-road to health. Dr. Keen was much surprised when, later, Dr. Kyle made the following report: 'Certain areas showed small nodules surrounded by dense fibrous tissue. The blood-vessels, while not entirely obliterated, showed thickening of the walls, especially the intima. It is undoubtedly tubercular.'

"In August, three months after the operation, the patient reported that his weight had increased to 171 pounds, and in October it had risen to 178½ pounds; his appetite, digestion, and assimilation were excellent, and he suffered no pain. In fact, his only trouble was an occasional sleepless night. His diet in August consisted of 'bread and butter, milk, eggs, potatoes, beefsteak, mutton, fish, rice, oatmeal, and fruit.' He had been taking some syrup of the hypophosphites and cod-liver oil in consequence of Dr. Kyle's report.

"Dr. Keen said that he had mentioned the names of the gentlemen present for the especial reason that those present at the operation, all men of large experience, agreed that the disease was unquestionably carcinoma of the stomach."

The apparent recovery of the patient had caused Dr. Keen, at first, to accept the view of Dr. Kyle, who first examined the removed nodule and gland, that the condition was one of tuberculosis. Later, but im-

mediately subsequent to the publication of Dr. Keen's report, and long before the patient again came under observation, sections from the supposed tubercular glands were submitted to Dr. Welch, of Johns Hopkins University, to Dr. Councilman, of Harvard University, to Dr. Adami, of McGill University, and to Dr. Prudden, of the College of Physicians and Surgeons, New York. These all reported no evidence whatever of tubercle, but that sections from the nodule showed it to be undoubtedly a metastatic cancer. Dr. Welch regarded it as scirrhus; Dr. Councilman, as adenocarcinoma; Drs. Adami and Prudden spoke of it as simply cancer. The preparations of the sections sent were regarded to be so poor that the exact character of cancer was somewhat in doubt. Dr. Councilman, however, pronounced it positively to be an adenocarcinoma.

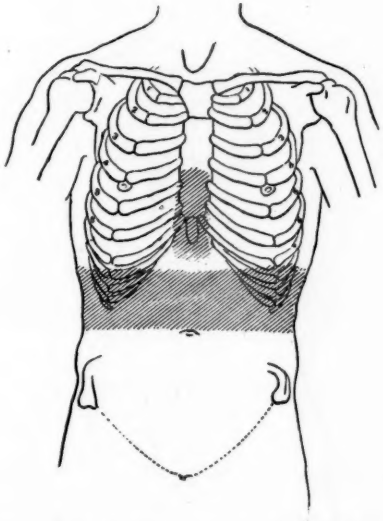
The subsequent history of the case is as follows:

The patient was referred to the writer by Dr. Keen in December, 1897, seventeen months following the operation. On getting about after the operation he had improved wonderfully in health, all gastric symptoms for a time practically disappearing. He gained rapidly in strength and flesh, so that at the end of five months he weighed nearly fifteen pounds more than he ever had before (175). During this time he had not resumed practice, but took every care of his health. After he had held this maximum gain about five months he began to lose weight without assignable cause. He had no gastric symptoms during this time; no epigastric distress, sour stomach, or nausea. He had, as was common with him for a number of years, but little appetite, and slept badly, and he was considerably disturbed by cramps in the calf muscles. He now spent several months in the mountains, and in September, 1897 (sixteen months after the operation), he returned to his home feeling in very good health and weighing 166 pounds. Shortly after this (October, 1897) gastric symptoms reappeared. These were nausea and occasionally a tendency to vomit if he ate very heartily. Heartburn or pyrosis was never evident. A regurgitation, which he described as "cold sweet water," occurred once or twice weekly. Because of loss of appetite he has lately been living largely on milk punches. About the middle of October, 1897, he began to feel gastric pain, and with its appearance a rapid drop in weight occurred (twenty-six pounds in two months). The pain was in the region of the sternum, in the back, and in the epigastrium. The sternal pain occupied a space from mid-sternum to a distance midway between the tip of the ensiform appendix and the umbilicus, and about three inches in breadth. (Fig. 1.) This pain he describes as most prostrating. He regarded it as intimately related in characteristics to a dorsal pain of most annoying character, the situation of which was, invariably, immediately to the right of the spinal column, between it and the vertebral border of the scapula, and extending from the fifth to the eighth ribs (Fig. 2). There was also a diffuse pain in the epigastrium and both hypochondria. These pains were all invariably more severe at night after retiring, especially that in the dorsal region. Otherwise the character of pain was interesting in that it was commonly felt, as in the pain of hyperchlorhydria,

at a time after food when excess of free hydrochloric acid becomes marked. Taking food, and especially meat, almost invariably relieved or removed all pain. Drinking freely of water, such as Vichy, also relieved the pain, although not to the extent that food did. The use of sodium bicarbonate, however, had no marked effect.

Unprovoked vomiting was unusual, and had not occurred for some time. He had formed a habit some weeks before I saw him of each morning drinking a pint or so of warm water containing sodium bicarbonate, and then emptying the stomach by regurgitating its contents. He could in this way relieve himself of any discomfort experienced. The rejected material rarely contained food eaten the night before. He stated there was usually a good deal of mucus, and that occasionally

FIG. 1.



The two areas shaded are those of pain, as decribed.

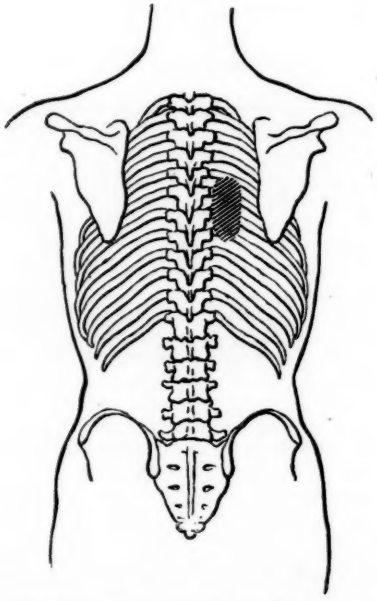
evidences of blood were noted. Inspection of the regurgitated matter showed it to contain altered blood. It was quite coffee-ground in character. He had been subject to constipation for years. The patient's skin was of cachectic hue. His general condition was really very good. His weight was 149 pounds, within ten to fifteen pounds of his best weight when in good health, and nearly thirty pounds in excess of his weight eighteen months before. During the two weeks he was under observation it was interesting that he gained seven pounds, indicating the still well-preserved recuperative power.

Physical examination of the organs of the chest revealed no abnormality; the lungs showed no sign of disease, and the heart was fairly strong and the sounds free from murmurs.

The abdominal wall displayed the healed cicatrix of the preceding

cœliotomy. Indications of local or general resistance in the stomach region, or of tumor, and abnormal glandular enlargement anywhere, were absent. The liver and spleen were normal in outline. The inferior portions of both kidneys were palpable only on full inspiration. The stomach, by ordinary percussion, by auscultatory percussion, by gaseous inflation, and by transillumination, was found to be normally placed. Indeed, by gastro-diaphany, as is here illustrated (Fig. 3), it was found to occupy a position considerably higher (three-fourths of an inch above the umbilicus) than is usual when fully distended with water, as the organ was at the time of this illumination with 1100 c.c. of water. The cause of this was subsequently made apparent (adhesions to the

FIG. 2.



The shaded area is the dorsal site of pain, as described.

abdominal wall and to liver). The transillumination with a lamp of three candle-power was perfect, the anterior surface of the organ being beautifully mapped on the abdominal wall. The scar area alone was shaded somewhat.

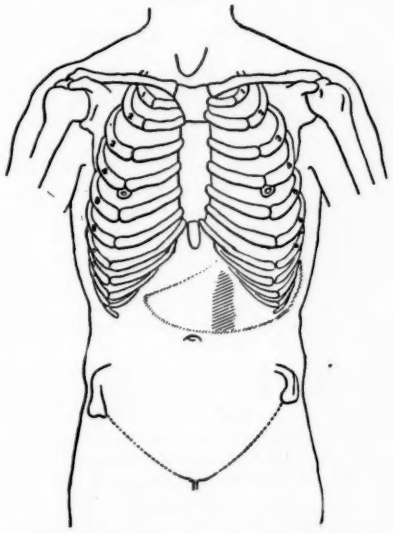
Examination of the urine showed it to be free from albumin, sugar, and casts.

For some time, as he thought that washing out the stomach would be beneficial, and as he disliked to employ the tube, his habit was to drink water and regurgitate it. He was able to report that food, other than in traces, was never present in the morning.

The examination of the stomach-contents was as follows:

December 7, 1897. Stomach washed and 500 c.c. of rather thick oatmeal gruel, flavored with salt, administered. Two and one-quarter hours subsequently, 300 c.c. were removed, practically all that remained, as was shown by subsequent lavage. Removed contents were dark red, showing on standing a copious dark sediment. The filtrate was clear. T. A. = 72; HCl = 0.2 per cent.; acid salts = 13; no lactic acid. Starch converted into erythrodextrose. Test for lab-zymogen: 10 c.c. milk, at 40° C.; 2 c.c. filtrate; solidification of the milk occurred within two minutes.

FIG. 3.



Transilluminated area, with shaded area of scar; stomach containing 1100 c.c. water.

8*th*. Stomach washed and 500 c.c. thick oatmeal gruel administered; 320 c.c. remaining in two and one-half hours. Coffee-ground sediment as before. Upper stratum, on standing, reddish hue. Filtrate not blood-stained. T. A. = 66; HCl = 0.19 per cent.; acid salts = 15. No organic acids. Erythrodextrose as before. Lab-test, under same conditions as above, positive in the same time.

Digestion test: in incubator at 40° C., egg disk approximately $\frac{1}{2}$ c.m. square, by $\frac{1}{6}$ c.m. thickness in each, 10 c.c. filtrate. One phial reinforced by an active preparation of pepsin. The disk in the phial unreinforced by pepsin had entirely disappeared in three hours; there were still faint remains of the disk in the phial in which pepsin had been added. The disks were of the same size, but, as they were not accurately weighed, that in the pepsin solution might have been a trifle larger, and, hence, caused this difference. This test was repeated with the filtrate from two other trial meals, and showed that the addition of pepsin produced no earlier disappearance of the egg disk than if it had

not been added. It showed that secretion of pepsin was in the same satisfactory proportion as the HCl.

It should be here remarked that the gruel meal on each occasion caused considerable gastric distress and pain, all of which disappeared instantly on their removal and washing out of the stomach.

9th. After lavage, a large, thick, tenderloin steak, 60 grammes of bread, 360 c.c. of milk were eaten. Four hours later 300 c.c. quite fluid contents were removed through the tube. A fair amount remained, as was shown by a subsequent lavage. Contents not blood-stained, although much retching was produced by the use of the tube. T. A. of filtrate = 151; HCl = 66. The digestion test was as above stated.

13th. The same meal taken as on December 9th. Removed at the same interval 300 c.c. No blood; contents of natural appearance. T. A. = 144; free HCl = 72.

It is noteworthy that, as remarked, while with the gruel meal gastric distress was always felt, relieved only by the removal of the meal, and subsequent washing, not the slightest trace of pain or discomfort was experienced during the digestion of the full meal of steak, bread, and milk. During the two weeks he was under observation this was found to be invariable in many trials. He could eat and digest with relish and freedom of symptoms a steak of good size.

Blood examination, December 9th. Red blood-corpuscles, 3,528,000. Hb. 46. This examination repeated later gave practically similar results. In the morning, fasting, leucocytes, 5940. Three and a quarter hours after a large tenderloin steak, milk, and bread, the leucocytes count was 7700; three-quarters of an hour later the count repeated was 8000.

Second day's examination. Nothing save oatmeal gruel had been taken, leucocytes, 6500. Four hours after a large tenderloin steak, bread, and milk, the count was 9000. These examinations were very painstakingly carried out, and may be regarded as entirely accurate. They show absence of pathological increase in the number of leucocytes, and the presence of a normal digestive leucocytosis. A differential count (1350 leucocytes) gave interesting results:

Polymorphonuclear neutrophiles	79.00 per cent.
Small lymphocytes	13.63 "
Large lymphocytes	3.46 "
Transitional leucocytes	2.42 "
Eosinophiles	1.49 "

This showed a pathological condition in the relative proportions of the leucocytes despite the absence of an increase in the total count, which on this occasion was 6500.

After this outlined study of the case, the opinion was given that the original trouble had been a long-existing hyperchlorhydria; that this, in all probability, had some years back been succeeded by ulcer, and that the ulcer had at least two years before undergone carcinomatous degeneration. Of course, this last statement would have been impossible but for the knowledge of the removal of the metastatic nodule. Indeed, but for this, the diagnosis of cancer itself at this time, in view

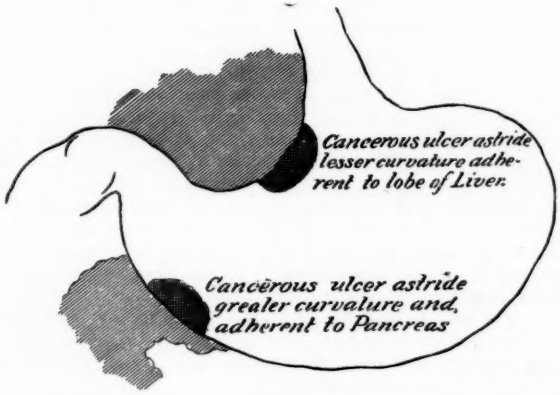
of the history of the case since the operation, would have been seriously in question. The growth was regarded as being in the body of the stomach, not encroaching on the pylorus. The diminished motility was presumed to be due to weakness of the musculature, through carcinomatous infiltration of the stomach wall. To this opinion I had Dr. Keen's concurrence. The patient placing himself in our hands, a second exploratory cœliotomy was advised, as at least offering a chance of again temporarily arresting the progress of the cancer. It was, moreover, hoped that an opportunity might be afforded for an excision of the growth, or, indeed, of a part or the whole of the stomach, should indications of external metastasis not be present.

Second operation by Prof. Keen, December 23, 1897. The anterior wall of the stomach was found to be extensively adherent to the abdominal parietes over a large area. On incision of stomach, its interior, as far as could be seen at first, presented a healthy appearance. Its wall was thinner than normal, but the mucous membrane everywhere looked normal. Palpation revealed no thickening anywhere except posteriorly and superiorly near the œsophagus, at which point a circular hard ridge of some size could be felt, and afterward was seen. This mass appeared to be a very large ulcer, with elevated callous edges. A small clipping from the edge was removed for microscopic examination. The ulcer was too close to the diaphragm and too far from the incision to permit of its removal, or of the removal of the stomach itself, because of the extensive adhesions. It was concluded to establish a duodenal fistule to permit of feeding in this way, so that, as is remarked by Dr. Keen in his notes, "If the ulcer be a non-malignant one it would heal within two or three weeks; if malignant, the rest to the stomach would, at least, do no harm." The patient, unfortunately, after the first few days did badly. Obstinate hiccough appeared; the external wound failed to heal, and he succumbed finally, eighteen days after operation, to a septic peritonitis.

The necropsy was performed by Dr. Keen eighteen hours after death. Through a misunderstanding, the body had not been placed on ice, and was already somewhat advanced in decomposition. The whole external wound gaped, with protrusion of stomach and intestine. The peritoneal cavity contained considerable pus. The heart and lungs were healthy. The liver was somewhat enlarged and pale; no evidence of metastasis here or in the peritoneum could be found. Spleen and kidneys appeared healthy. The stomach was normally placed and undilated. It was adherent to the abdominal wall, and superiorly, through the entire length of the lesser curvature, to the under surface of the left lobe of the liver, and posteriorly, at the base of the lower ulcer, to the pancreas. The pancreas appeared normal, and microscopic examination subsequently disclosed that it was so. Section of the stomach showed some softening of its walls due to post-mortem changes. Two large and entirely isolated ulcers were now noted. One, the nearest edge of which was 1½ cm. from the cardiac orifice, was astride the lesser curvature, with the larger portion toward the posterior wall. It was adherent by its base to the inferior surface of the left lobe of the liver. This ulcer was in the largest diameter 8½ cm. and transversely 6 cm. It

was of ovoid shape, with crater-like raised thickened edges. The margins were especially prominent on the portion nearest the cardia; here the edge measured in one part 1½ c.cm. The floor of the ulcer was indurated, smooth, and depressed, and adherent to the left lobe of the liver. The second ulcer was situated astride the greater curvature, 7 c.cm. from the pylorus. It was of circular outline, with thickened, elevated, sloping edges, like the first described, and with a slightly excavated, considerably indurated centre. This ulcer was adherent to the adjacent part of the pancreas. It measured 5 cm. in length by 4½ cm. in breadth. The edges of both ulcers were œdematous, hemorrhagic, and somewhat polypoid. Immediately surrounding the ulcers the stomach-wall was somewhat indurated, but this was not evident for any distance. There was apparently no connection between the two ulcers, which were widely separated, as is shown in the accompanying cut and in the photographs.

FIG. 4.


Cancerous ulcer astride lesser curvature adherent to lobe of Liver.
Cancerous ulcer astride greater curvature and adherent to Pancreas

The lumen of the pylorus was narrowed through fibrous and muscular thickening of its wall. It admitted with difficulty only the tip of the index-finger.

The specimen was first given to Dr. A. O. J. Kelly, to remove portions for microscopic examinations. Subsequently portions of the growths were sent by Dr. Keen to Drs. Welch, Councilman, Adami, and Prudden.

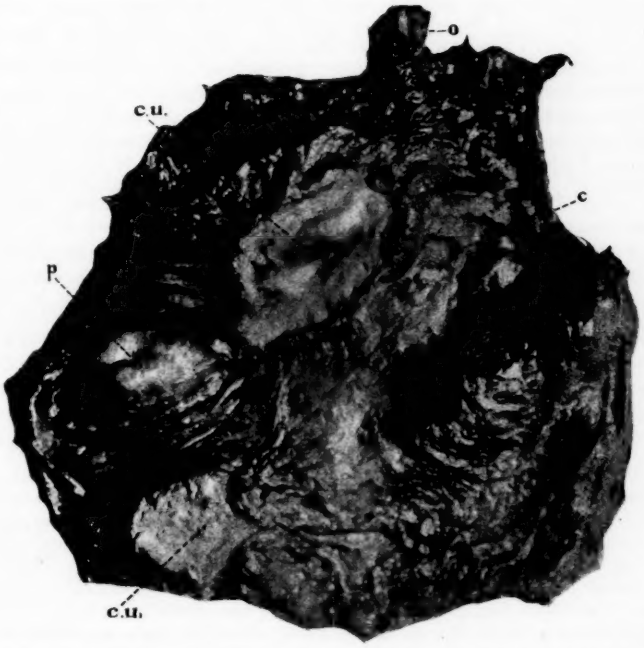
Dr. Kelly's report is as follows:

Microscopical Examination. The specimen had been placed in alcohol, but is in a very poor condition. Some areas are in a state of putrefaction and do not permit of a careful study of histologic details. This is especially true of the larger ulcerated area situate on the posterior wall toward the lesser curvature. The smaller ulcerated area situate at the posterior-inferior region toward the greater curvature is in a fairly good state of preservation.

Sections through the edge of this latter ulcerated area reveal a carcinomatous new-growth arising from the mucous coat, implicating the

latter, and also the submucous, the muscular, and the subserous layers of the wall of the organ. The mucous and submucous coats are entirely replaced by the new-growth; the muscular and the subserous are also considerably invaded and to a less extent replaced. The growth consists of cells arranged in alveoli and surrounded by a connective-tissue stroma. The alveoli, which pervade the tissues in all directions, vary greatly in size and shape. For the most part they are elongated and narrow. Others are much wider and very irregular. The cells are of distinctly epithelial type. They commonly line the alveoli, leaving a central lumen, which is in some places free, in others more or less filled

FIG. 5.



C. Cardia. *C. u.* Carcinomatous ulcer. *O.* Œsophagus. *P.* Pylorus bulged into the stomach in order to show the thickening and narrowing.

with detritus. Other alveoli, in addition to being lined by the cells, are completely filled by them. The cells are predominatingly high-cylindrical in shape, especially those which line the alveoli and leave a clear lumen. Other cells constituting the periphery of solid nests of cells appear more cubical. Still others, and all situate toward the centre of the alveoli, are polymorphous. The cells reveal distinct nuclei, which stain readily; those of the cylindrical cells being situate toward the base of the cells. Nucleoli are also discernible. There are at present a few karyokinetic figures which are generally hyperchromatic. Many

of the cells, especially those situate toward the centre of the nests, reveal various retrograde metamorphoses. The stroma, which consists of fully developed fibrillar connective tissue, varies considerably in different regions. In places it is abundant, in others scanty. Its nuclei present some karyokinetic figures, and the tissue itself is the seat of considerable round-cell infiltration, which latter exhibits many evidences of retrograde changes. The bloodvessels, particularly the larger ones, manifest, for the most part, thickened walls. Toward its free surface the neoplasm is markedly necrotic, and this process is complete at the central area of ulceration, where it extends to and implicates the muscular coat of the stomach. The latter is markedly hyperplastic. This, together with the fibrous overgrowth, mainly of the submucous coat, and the tumor-mass itself, occasion the marked thickening and polypoid condition of the edge of the ulcerated area. Away from the seat of ulceration there is a gradual transition from the tumor-alveoli to apparently normal gastric tubules. There first occurs a diminution of the obviously neoplastic alveoli, then a succession of irregular gastric tubules, and finally apparently normal tubules. Nests of cancer-cells also invade the muscular coat for a short distance from the ulcerated edge. These transitional stages, however, apparently do not implicate more than 1 to 1.5 cm. of the stomach-wall beyond the ulcerated edge. A section 2 cm. from this edge fails to disclose any noteworthy deviation from the normal.

Sections through the edge of the larger ulcerated area, situate toward the lesser curvature, reveal conditions which, as far as can be definitely determined in view of the decomposed state of the specimen at this region, are entirely analogous to those already detailed in connection with the smaller ulcerated area. The alveoli, however, are in many instances much larger, and the cells arranged much more irregularly. In the deeper layers of the stomach-wall there are a few cystic spaces lined with cylindrical epithelium.

Sections through the pylorus reveal it to be 1 to 1.2 cm. in thickness. Both the muscular and the fibrous layers of the wall are implicated in this overgrowth. There is no carcinomatous invasion of this region. Sections from two areas between the two ulcerated surfaces fail to reveal any evidences of carcinomatous alteration. The structures here present no especial deviations from the normal. The same is also true of sections from a region near the pylorus between the ulcerated areas.

Diagnosis. Double ulcerated adenocarcinomas of the stomach. Each ulcerated area singly considered presents no especial deviations from that type of carcinoma of the stomach of which these are instances. The interest in the specimen centres in the fact that in the same stomach there are found two carcinomas apparently unconnected with each other. There is no diffuse carcinomatous infiltration of the wall of the stomach, and aside from the marked thickening of the pylorus and about the ulcerated areas there is no especial implication of the fibrous connective tissues, certainly no diffuse pathological alteration of this structure.

The others, except Dr. Prudden, reported similarly, that sections from the portions of the two ulcers submitted showed them to be ulcerated typical adenocarcinomas. Dr. Prudden briefly reported that the growths were carcinomatous. The specimen had not been well pre-

served when the portions were subsequently sent to the others. Dr. Welch, in his report to Dr. Keen, after remarking on the badly preserved condition of the specimens sent him, which made study of them somewhat difficult, said that the essential points could be determined. There could be no question as to cancer and its type, and that a careful search revealed no distinct evidences of disease for a distance of much more than 1 cm. beyond the ulcers.

There are several features in this case of very special interest. The early history left little doubt concerning the existence of a long-standing gastric neurosis with associated hyperchlorhydria. That one or more gastric ulcers should appear in a subject of chronic hyperchlorhydria, debilitated by grief, overwork, and inanition—induced both by these causes, as by total anorexia, superadded to long-existing indigestion—cannot be a matter of surprise. Nor could it that a simple peptic ulcer should subsequently be the seat of carcinomatous transformation. Such cases, though not numerous, are on record. The features which, however, are most interesting about the case are as follows: The apparent extensive disease of the body of the stomach at the time of the first operation; the apparent recovery of the patient and the surprising increase in weight to a point beyond that ever reached in health, and its maintenance for so long a time in one then the probable subject of two separate carcinomas, which had already given rise to a nodular metastasis in the omentum; eighteen months subsequently the fairly good physical condition; the really small loss from the weight usual in health—this was in a measure explained by the remarkable preservation of the digestive condition, which in itself was noteworthy; the freedom from pain when the functions of the stomach were taxed to their utmost, as in the digestion of a heavy meal of proteids; the existence of two unconnected cancerous ulcers in the stomach. Also noteworthy was the presence of a digestive leucocytosis with absence of a pathological increase in the number of leucocytes.

In view of the finding at the time of the second operation, and the post-mortem revelations—the practical limitation of the disease to the two cancerous ulcers—the condition noted by Dr. Keen and observed by others present at the time of the first operation seems quite inexplicable. The only attempt at an explanation is that there must have occurred during the whole time the stomach-wall was exposed a tonic contraction of this viscus, throwing it into folds, and thus originating the nodular condition simulating organic disease noted. Although this seems improbable, and it is, moreover, unlikely that Dr. Keen's years of anatomical and surgical experience, rendering him so familiar with the appearance of the healthy and diseased stomach, would have permitted him to be deceived, no other explanation is at hand. For the fact remains that no evidence of gross or minute departure from the

normal could be found to exist in the stomach-wall save at and immediately about the site of the ulcers. But if one with the extensive experience and keen powers of observation of the surgeon named could be so misled, not to speak of the others present who were similarly led astray, it indicates the extreme caution necessary in forming a judgment as to the condition of the stomach concerning presence or absence of a growth without an incision into that viscus.

The temporary entire subsidence of symptoms with decided increase in weight is occasionally noted after mere exploratory operation in cases of cancer of the stomach.[1] While temporary removal of symptoms after a gastro-enterostomy, in cancer producing obstruction of the pylorus, may be readily enough understood, the same after a mere exploratory section, if a causal relation can be traced, is in itself mysterious. I am unaware of any case similar to my own in which actual *apparent recovery* followed, the patient *remaining so long free from symptoms*. The explanation why a mere exploratory section in which the involved organ is not disturbed should be so promptly followed by cessation of symptoms and decided and long-continued general improvement in health as to indicate some relation between the operation and improvement, is not at hand. The quite common occurrence of marked amelioration in symptoms, if not actual removal of the disease-process in tubercular peritonitis, following a mere exploratory section, is well known. Apparently, also, though it has been rarely noted, an extensive syphilitic gummatous formation in the liver may, without the employment of mercury or the iodides, be influenced in the same manner —as in a case reported by Stengel (see *Annals of Surgery*, June, 1897, discussion on Dr. Keen's paper). More frequently than the latter, but immeasurably less common than the former, are the observed cases in which so great an amount of symptomatic improvement has occurred following a simple cœliotomy in gastric cancer as to indicate the existence of a direct active relationship between the operation and improvement. Yet these last are not known to be cases in which more than retardation of the growth was produced. We have no knowledge as to actual, partial, or complete disappearance of cancer of the stomach. It can only be said that such an occurrence is theoretically not impossible, if for no other reason, in view of the occasional observed disappearance of cancer of the external parts, such as epithelioma, during the administration of full doses of arsenic. That in the case under observation a growth more extensive than was found post-mortem had

[1] I speak here of *entire* subsidence of symptoms. I believe there is no authentic instance of total disappearance of all gastric symptoms with considerable gain in weight, the whole maintained for some months, in a case of well-developed cancer of the stomach treated medically. It is true that short periods of improvement often occur in cases under no special treatment, and that marked amelioration will often follow resort to the tube. But even in these last cases the symptoms never entirely disappear, nor is the gain in weight extensive or long held.

previously existed, the histological examination failed to reveal evidence. If carcinoma could be regarded as a germ disease, the likely explanation of cessation of growth and the occurrence of systematic improvement as the result of section in many cases of tubercular peritonitis—that of Kischenski—might be applicable here: that the result is due to a post-operative leucocytosis. If this were so, then it might be thought that the administration of nucleins would give similar results in cases of carcinoma in which there is yet at hand a fund of recuperative power. The nucleins, however, produce a physiological and not a pathological leucocytosis, the increase not being, as is usual in the latter, in the polymorphonuclear leucocytes, but, to a similar degree, in the young cells.

As factors assisting whatever gave the original impetus to the improvement in the case were the vigorous recuperative power presumed to be possessed by the patient, the well-preserved digestive function, and the freedom from involvement of the apertures of the stomach in the cancerous process. The character of the carcinoma, too, has to be somewhat considered. Although not the slow-growing form, such as schirrus, adenocarcinoma is not supposed usually to tend to rapid metastatic extension. As was remarked by Dr. Adami[1] concerning this case, "columnar-celled cancers of the stomach are puzzling growths, in that of all forms of cancer of the stomach they appear to remain for the longest period purely local, and only infiltrate very slowly." If we do not consider the presence of the growths in the stomach, evidently but an isolated metastatis had occurred at the time of the first operation.

Although nothing in the microscopic or gross appearance of the two growths permits the assertion that they were primarily simple peptic ulcers which subsequently became carcinomatous, there is every probability that this is so, from the history and from our knowledge of similar cases, and from the fact that two identical separate ulcerating cancers were found. Whether the cancerous transformation of the ulcers was simultaneous or occurred serially, the second by infection from the first, is impossible to affirm positively. The latter is, of course, very probable. Infection by continuity of structure was scarcely likely, as was shown by the histologic examinations.

Infection may have occurred from contact through the occasional approximation of the two diseased surfaces of the empty stomach, the cancerous ulcer on the superior curvature near the cardia thus inoculating the simple ulcer on the inferior curvature; or particles of growth from the first, becoming dislodged, could easily have found their way to and a resting-place on the site of the ulcer on the greater curvature.

[1] In a private communication to Dr. Keen.

One might suppose that the very active digestive secretion, presumably always manifest in this case, would have tended readily to destroy the infecting principle before inoculation could occur. But we know too little of the intimate nature of this principle, or of its power of resistance, to hazard judgment on this point. At all events, the second ulcer was probably directly infected from the other cancerous ulcer. Other instances of presumed communicability of cancer are on record, such as epithelioma of the penis from coitus in a case of cancer of the cervix.

From the situation of the growths, encroachment upon the secretory power of the stomach did not occur; the stomach up to the time of death had practically normal function. Motility was somewhat interfered with, apparently not in consequence of the growths, but because of a slowly increasing pyloric hypertrophy with connective tissue increase, likely the result of the long-continued irritant action of excessive secretion of HCl.

The preservation of a digestive leucocytosis in this case, commonly but not invariably lost in cancer of the stomach, could not be a matter of surprise. Nor could it furnish to the thoughtful observer any valid evidence against malignancy, as the explanation for its preservation here is so evident. While the absence of a digestive leucocytosis is not in itself significant of cancer, commonly noted as it is in all maladies of the stomach in which peptonization of nitrogenous pabulum and its passage into the bowel are interfered with, its presence has been held to point strongly against that affection. Recently some exceptions to the rule that a digestive leucocytosis is invariably absent in cancer of the stomach have been recorded. This is not a matter of surprise. It is rather a matter for wonder that it could be supposed that the condition for the absence of a physiological increase of leucocytes after a meal of proteids should be always the same in gastric carcinoma. With a growth involving the pylorus, especially if associated, as is usual, with a practical loss of secretion of HCl, absence of a digestive leucocytosis is to be expected. But, as in this case, with the preservation of the secretory power and fairly good motility, the ability to digest a full meal must have its usual effect upon the blood. It was more surprising that a pathological leucocytosis involving a notable increase in the number of leucocytes in the circulating blood was not evident in a case of cancer so long existing. Although a pathological leucocytosis is not as common in advanced cancer of the stomach as in cancer of other organs or parts, it is usually met with in fair degree except when the disease is in a situation to obstruct the cardia. It was especially interesting that, although an actual increase in the number of leucocytes had not occurred, a pathological leucocytosis was in reality actually present, showing itself in an alteration in the normal relation of the

varieties to each other, the polymorphonuclear elements existing in the percentage of 79. Attention, I believe, is not enough given to the significance of the occurrence of a mere relative increase of adult cells in cases in which no increase in the absolute number existed. Here 79 per cent. of polymorphonuclear leucocytes in a subject lacking in vigor, if not attributable to the occurrence of blood oozing from the sites of the cancers (the only other assignable cause evident), had its indication.

The diagnosis of a case of this sort is naturally attended with difficulty. The presence of carcinoma engrafted on an open ulcer, unless the latter has existed for a long time, has been often overlooked in life, so gradual is the merging of symptoms of chronic ulcer into those of cancer.

The diagnosis of these cases lies commonly in the recognition of a *carcinoma ex ulcere*. The ulcer has usually plainly enough preceded for a more or less long time the development of malignancy, producing the familiar characteristic symptoms. Not infrequently, however, gastric ulcer is for a long time latent. The usual symptoms may not be at all manifest. There may be practically no symptoms complained of, or those noted may consist of a simple heightening in the secretion of HCl, or those of a gastric neurosis unassociated with hyperchlorhydria may be alone manifest. The symptoms of presumptive ulcer first remarked may then be really those of the developing cancer. The case under consideration was of this sort. During the six years symptoms were largely those of a pronounced neurosis associated with hyperchlorhydria. The gastric discomfort spoken of here was so explained, except that the uneasiness or pain occurring several hours after taking food, extending to the back, should have excited the suspicion of ulcer. No vomiting had occurred and no hemorrhage had been noted until six years had elapsed, during the whole period of which doubtless ulcer existed. The growth had then been present sufficiently long to produce a secondary distinct cancer in the stomach and a nodule in the omentum. In such a case as this, especially in the period following operation, the great improvement in the general condition, with the practical cessation of symptoms and the enormous gain in weight, would have made the diagnosis of carcinoma of the stomach very difficult. Even eighteen months succeeding operation, when the frequent appearance of coffee-ground material in the stomach-contents, usually so strongly suggestive of cancer, was evident, other symptoms pointed so strongly against that condition that its certain recognition was impossible, at least without the discovery of bits of the growth in the stomach-contents, here searched for, in the short time he was under observation, in vain. No doubt particles of the growth in a case of adenocarcinoma could eventually have been found had opportunity for any prolonged search been permitted. The diagnosis being regarded

as settled from the knowledge of the character of the metastatic nodule, the finding of cancerous particles was not necessary.

In the diagnosis of a case of doubtful carcinomatous ulcer, apart from points mentioned, the following are also to be considered: the loss of weight and the cachexia both apt to be out of proportion to what is usual in ulcer. The occurrence of constant oozing of blood, appearing as coffee-ground material in the vomit or in the wash-water, is significant of cancer rather than ulcer. Also important is the lack of decided response to the improved methods of treatment for ulcer, which usually rarely fail in prompt result in cases in which the lumen of the pylorus is not obstructed. Not long ago this, with the more or less constant presence of coffee-ground material in the vomit, led me to diagnosticate correctly carcinomatous degeneration in a case of chronic ulcer that had been under observation only a short time. The diagnosis was confirmed by finding a bit of the growth (an adenocarcinoma) in the wash-water. The loss of weight may not be more marked than in ulcer, especially if the ulcer be so situated as to produce pyloric obstruction. The patient, also, may be very responsive to treatment for a time, as was true in the case just spoken of and in that of the subject of this paper. The extraordinary gain in the latter after the first section, with cessation of symptoms, could not but tend to mislead. Such a gain, long retained, however, is unknown as a result of any medical treatment of cancerous ulcer.

The general question of diagnosis of carcinomatous ulcer must be deferred for fuller consideration in a second paper in which another case the writer has encountered and diagnosed in life will be described, as will be a case of chronic ulcer in a man of middle age, in whom adherent omentum caused the presence of a pyloric tumor suggestive of carcinoma. The present paper is intended merely as a report of what the writer regards as a remarkable case, worthy of isolated publication.

REVIEWS.

MORPHOLOGY OF THE CEREBRAL CONVOLUTIONS, WITH SPECIAL REFERENCE TO THE ORDER OF PRIMATES. By ANDREW J. PARKER, M.D. Journal of the Academy of Natural Sciences of Philadelphia. New series. Vol. x. Part 3.

THE publication of this work is largely due to the efforts of Dr. Dercum. The author devoted many years of his life to its preparation, but did not live to see it in print. The numerous illustrations have been most carefully prepared from photographs taken by Dr. Parker. The principal object of the paper is to draw attention to a new view of the morphology of the cerebral convolutions in primates, and to show that they are related to a symmetrical bud-growth of the cerebral hemispheres.

The conclusions are largely founded on the studies of the brains of related animals and on the embryology of the human brain. If it can be shown that the convolutions are based upon a symmetrical plan related to the structure of the hemisphere, it may have interesting bearings as regards the functions of the different portions of the cerebral cortex itself, although it is not known as yet how closely these functional districts correspond to the convolutions.

Dr. Parker believes that the fissures represent lines of retarded growth with respect to the convolutions, and, as they have a morphological significance in reference to the cell-growth of the brain, they may represent lines of structural demarcation. Several pages are devoted to the literature on the arrangement of the convolutions and fissures; the nomenclature and synonymy of the fissures and convolutions in the primates are then treated of at length.

In regard to the manner of formation of the fissures the writer believes that certain of these and of the convolutions, including the most important, are produced by merely mechanical causes, whilst others owe their origin to morphological processes of growth in the brain substance itself, the fissures representing lines of retarded, whilst the convolutions represent areas of increased, growth. In highly convoluted brains we may expect to find areas of growth rising from the depths of the original and primitive fissures.

Dr. Parker distinguishes only three lobes in each hemisphere, an anterior, an inferior, and a posterior, which he calls the occipito-frontal, occipito-temporal, and occipital. The parietal lobe does not represent a lobe of the hemisphere in any morphological sense comparable or homologous to the three lobes mentioned. The island of Reil, also, is not in any sense morphologically similar to the other lobes.

The temporary furrows found in the early months of fœtal life are due to greater growth of the hemispheres in proportion to the growth of the skull, and the fact that the cerebral sac later becomes smooth

again proves that the skull accommodates itself to this increased growth by more rapid expansion, and, as a consequence, these plications unfold. On the outer surface they radiate toward the middle of the fossa of Sylvius, which evidently is the centre of pressure, on the mesial surface; the mathematical regularity is even more pronounced, as the resolution of forces takes place along a plane instead of upon an irregularly spheroidal surface. The triradiate fissure of the mesial surface (composed of the callosal, hippocampal, and calcarine) is made by an inrolling into the ventricles as a result of pressure. As development proceeds beyond the fourth month the brain again becomes almost entirely smooth.

The primary fissures of the primate brain are the fissure of Sylvius and the mesial arched fissure (triradiate); these are the first to appear in the development of the human brain and all other primates, and have definite relations to the hemisphere itself and to all other fissures and convolutions which appear later; they are produced by purely mechanical action taking place between the growing brain and the expanding skull. The Sylvian fissure is found in the brain of man at the end of the third month. The closing in of the island of Reil is partly due to the growing upward of the temporal lobe, but mainly to a rolling downward and backward of a fold of the frontal lobe over the floor of the fossa, and thus gradually shelving it in. In the brain of the negro the island is not as well covered in as in the white man, and approaches in this respect a more fœtal character. The Sylvian fissure also has a somewhat different form in the negro brain. There is not one of all the points which have been asserted to be characteristic of the convolutions of the human as distinguished from the ape brain which the study of the negro brain will not show to be entirely relative.

In man the occipital lobe reaches its highest complexity, and is the last to develop completely. The nomenclature of the ape brain can be transferred directly to man even in describing this lobe, and positive advantage arises therefrom.

In the negro brain the calcarine fissure is continuous throughout its entire length, the development of annectant folds in the white brain in the calcarine fissure is an indication of high cerebral development, and, instead of fissuration giving rise to convolutions, we find through local morphological development the evolution of convolutions giving rise to the production of new fissures.

The brain of an adult monkey, Hapale midas, of a fœtal monkey, Cebus, and the brain of man in one stage of his existence are similar as regards type of fissuration; a beautiful illustration of that firmly established principle that what is transient and embryonic in a higher form is permanently represented in a lower; and that the history of development of an organ tells us the history of its origin. The primary occipital arch (Parker), composed of the combined fissuræ perpendiculares interna and externa, or superior occipital fissure and inferior occipital fissure, cuts off distinctly the occipital lobe in the monkey's brain.

The central fissure is comparable to the posterior portion of the superior occipito-frontal fissure, and the anterior and posterior central convolutions Parker regards morphologically as displaced posterior portions of the superior and middle frontal convolutions. The central

fissure, owing to this downward development, becomes completely separated from the superior frontal.

The fissura occipitalis transversus represents the external perpendicular of the ape brain, which has been thrust backward and variously contorted by the increased convolutional development taking place in this region.

The *plis de passage* of the occipital lobe are nothing but the posterior extremities of the occipito-frontal and occipito-temporal convolutions, which are checked in their development by the evolution of the occipital lobe in the primates, and finally reach the surface by a renewed growth in this region.

The identification of the crucial fissure of the carnivora with the fissure of Rolando is morphologically incorrect; the former is really a vertical and lateral development of a fissure of the mesial surface.

The lobulus centralis appears to be peculiar to the primate brain. All fissures of the hemisphere may be divided into five classes:

1. Fundamental primary or typical fissures.
2. Secondary fissures: those giving special character to the type of convolutional configuration.
3. Vegetative repetitions of the secondary fissures, which increase the complexity of the cerebral surface, and may be termed sulci.
4. Sulculi: which give special characteristics to particular groups of brains and are usually repetitions of sulci, or small and apparently irregular fissures.
5. Rami: constant branches of fissures or sulci.

A brief chapter is devoted to the study of the convolutions and fissures in some of the other orders of mammalia; this is followed by a chapter devoted to a mathematical theory in regard to the formation of cerebral fissures, based on the principles deduced by Plateau from a study of the laws of formation of partitions formed by spherical liquid films, such as are made by the meeting of two or more soap bubbles. W. G. S.

DIE ZUCKERKRANKHEIT UND IHRE BEHANDLUNG. VON PROF. DR. CARL VON NOORDEN. Zweite vermehrte und umgearbeitete Auflage. Berlin: Verlag von August Hirschwald, 1898.

DIABETES MELLITUS AND ITS TREATMENT. By Dr. CARL VON NOORDEN. Second revised and enlarged edition.

THE first edition of this work, an English translation of which appeared in a large *System*, at once became popular, and there can be no doubt that a similar reception awaits the present edition. The alterations and additions mentioned in the title occur on almost every page, but, by omitting many sentences or paragraphs the matter of which was obsolete, the volume is no larger than its predecessor. The good points of the work are all preserved. These are, especially, clearness in stating the present knowledge of diabetes and the various theories of its origin, and an equally lucid method in giving the clinical picture and explaining the diagnosis, prognosis, and treatment. If the theories are not analyzed in great detail this must be com-

mended by those who wish to use the work with reference to practical medicine. No doubt the study of 353 cases of diabetes made by von Noorden is the cause of his judicial method. His candor is shown by the frank way in which he withdraws his former view regarding the relation of aceton to food- and body-albumin, a change due to the researches of Weintraud and others, confirmed by himself. Von Noorden controverts the idea that a marked aceton reaction in the urine is an absolutely bad sign, especially when it does not disappear under a diet such as should increase weight. Large amounts of aceton often appear in the beginning of a dietetic cure. Even less certain in prognosis than the aceton reaction is the diacetic acid reaction (of Gerhardt). A positive test for this, with aceton present, should, according to the author, not deter one from carrying out strict diet. Marked reaction for aceton and diacetic acid, with oxybutyric acid, is always serious, he goes on to show, but still they do not furnish grounds for abandoning strict diet; on the contrary, they indicate the withdrawal of carbohydrate food. Since the opposite view, a very seductive one, has been spreading recently, the unexcelled opportunities of the author for basing his statements on careful experience should be borne in mind. His remarks on prognosis in the class of cases described are equally valuable. The traumatic origin of diabetes, so much more important in Germany than elsewhere, is discussed clearly, and, like most German work touching accident insurance, is not likely to prejudice the plaintiff's case. As regards treatment, that by diet and regimen is carefully described. Organotherapy in all forms receives summary condemnation. The section on drug treatment is slightly extended, as compared with the first edition, but, except opium and possibly jambul, all specific medication is discarded. Although it is admitted that opium lessens the excretion of sugar, the bad effects of that drug are forcibly stated and the harm of its routine administration is made clear. The careful use of such a work as this must be productive of much good, and it may therefore be cordially recommended to the profession. G. D.

DIABETES MELLITUS AND ITS TREATMENT. By R. T. WILLIAMSON, M.D. (Lond.), M.R.C.P.; Medical Register, Manchester Royal Infirmary; Honorary Medical Officer, Pendleton Dispensary (Salford Royal Hospital); Assistant to the Professor of Medicine, Owens College, Manchester. Pp. xi. 417. New York: The Macmillan Company, 1898.

IN this work the author has endeavored to present a more detailed account of this disease than is generally found in text-books or systems of medicine. Notwithstanding the wealth of literature upon this subject, he has been content to study the most important, and for that reason his bibliography does not claim to be complete. Yet it is ample for the purpose of the work and bears evidence of careful selection. Upon this and upon about one hundred instances of diabetes mellitus this book is based, and the clinical and practical sides of the question have been always foremost. In the arrangement of the work he proceeds from sugar tests to physiological considerations, taking up in succession the work of experimenters who have produced glycosuria by various

methods, etiology, symptomatology, complications, diabetic coma, pathological anatomy, forms of the disease, terminations, prognosis, and, finally, treatment. Inasmuch as most of the lesions found post mortem are nearly always secondary, or due to complications, these are briefly mentioned in the chapter on the pathological anatomy, but described in detail as each complication is presented. The lesions found in the pancreas and nervous system, however, are presented in the sections devoted to the relation between diabetes and changes in the pancreas and nervous system. Of the many suggestions which this book offers but few can be mentioned. From the stand-point of the physician the fermentation test, but with the precautions noted, is very properly preferred. As for causation, he turns more especially toward the pancreas and the floor of the fourth ventricle and adjacent nervous structures, yet he is fair in believing that these are by no means the only places in which we may seek for the origin of the disease. That he has thoroughly worked over recent literature is shown by his appreciation of Pavy's latest investigations (p. 67). An addition of real value to our knowledge is found in the author's simple method of distinguishing diabetic from non-diabetic blood—the decolorization of methylene (not methyl) blue, which is to be found on p. 191 (not 171 as the cross-reference on p. 293 has it). This is of especial importance in distinguishing diabetic from other forms of coma. As for the termination of the disease, we agree that coma is the more frequent, but we doubt if it so greatly preponderates as he would have us believe (29 in 42). In our experience, death from cardiac failure comes closely to the coma percentage, even exceeding that from pulmonary (generally tuberculous) disease. Perhaps the greater latitude in diet which has been permitted may account for the latter discrepancy.

Upon the various drugs employed in treatment the author places but moderate reliance. Martineau's observations upon the combination of lithium salts and sodium arsenate have apparently escaped him, and this is also true of both the ancient and the recent work upon jambul. His strictures upon diabetic bread are none too severe (p. 348). In this connection the services of Bouchardat in the introduction of gluten as a food for diabetics is not so important as his observations upon the value of exercise, which, however, the author does not quote. The tables concerning koumiss (pp. 336 and 337) may lead to confusion unless the text is very carefully read. The appendix contains an excellent table which is useful when for diagnostic or therapeutic purposes a very strict diet is desirable.

We have read this book with profit and pleasure. The best of the literature is presented, and the conclusions deduced therefrom tempered by the author's own observations. Much satisfaction can be found in the fact that many *lacunæ* have been filled and our knowledge is becoming not only extensive but exact. As for the curability of the disease, we believe that a larger observation would show that the outlook is brighter, and that if entire relief in a given instance is not attainable the existence of the disease is by no means incompatible with a long, comfortable, and useful life. To accomplish the most each patient should be the subject for individual study, while hard-and-fast rules should be thrown aside, and toward this the author has rendered noteworthy service.

R. W. W.

CLINICAL DIAGNOSIS: The Bacteriological, Chemical, and Microscopical Evidence of Disease. By DR. RUDOLF V. JAKSCH, Professor of Special Pathology and Therapeutics, and Director of the Medical Clinic in the German University of Prague. Translated from fourth German edition, and enlarged by JAMES A. CAGNEY, M.A., M.D., Member of the Royal College of Physicians of London, etc. Third edition, with numerous illustrations (partly colored). Pp. 523. London: Charles Griffin & Co., 1897.

THE name and works of v. Jaksch are so well known to the student of clinical chemistry and microscopy that it would be carrying owls to Athens to enter again into a detailed account of the work before us. The German edition, of which this is the translation, appeared in the fall of 1896, and in a measure brought the work up to date. A number of additions have been made, and the section on helminthology is almost entirely rewritten. The new illustrations which have been substituted for the older ones in this chapter are really excellent. We are rather disappointed, however, to find that the chapter on the Blood is still rather imperfect, and we sincerely hope that this portion will receive a thorough revision in the next edition. An adequate idea of the advances which have been made in this subject during the last few years is really not given. Leucocytosis is dismissed with but little more than one page, the technique of blood examinations on the lines of Ehrlich's work is very imperfectly considered, and v. Jaksch's account of our present knowledge of the parasite of malarial fever is likewise defective.

The chapter on the Urine is unquestionably the best and the most complete, but perhaps also a little too conservatively written. Nevertheless, the student will here find practically all that is of value from the stand-point of diagnosis. There are, of course, a great many problems in this connection, concerning which a uniformity of opinion does not exist among workers in this branch, and though, as a rule, v. Jaksch presents the subject from a neutral stand-point, he is at times, perhaps, a little too authoritative in his statements. As coming from a pioneer in this subject, however, such statements nevertheless demand attention.

The chapter on the Feces is fairly complete, but it is rather disturbing, to the American reader, at least, to find the significance attaching to the presence of the amœba coli in the stools and the description of the parasite disposed of in a few lines. The English translator might well have enlarged on this, to us, most important subject. The excellent work of Councilman and Lafleur we have not even seen mentioned.

The identity of the trichomonas vaginalis and intestinalis has likewise been overlooked. Under the heading of the Gastric Juice we note that Töpfer's method of testing for free hydrochloric acid, as well as his quantitative method, have not been described, while some of the older and less reliable methods are still retained. It must be admitted, of course, that the advances in clinical chemistry and microscopy have been so great during the last few years that it is almost impossible to keep a work upon these subjects thoroughly abreast of the times. We must confess, nevertheless, that we had hoped for a more thorough revision at the hands of the author, as well as those of the translator.

Sixty-one pages of the book are devoted to Bibliography—a feature which renders the work most valuable to the special student of this branch. The index, as in the former editions, is excellent, and the publisher's work very well done. C. E. S.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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Erythromelalgia in Disease of the Spinal Cord.—Mitchell in his second paper (1878) put forward the opinion that this remarkable condition might in the future be found associated with distinct lesions in definite regions of the brain or cord. Cases have been reported in connection with locomotor ataxia and with acute disease of the spinal cord, but the most extensive collection of cases in connection with central disease has been reported by JAMES COLLIER in the *Lancet* for August 13, 1898. He has met with ten cases in the short period of six months' service at the National Hospital for the Paralyzed and Epileptic. This is a very remarkable experience when one considers that a recent writer on the disease, Rost, states that there are in the literature only some forty genuine cases. Six of Collier's cases presented the signs of disseminated sclerosis, two were cases of tabes, one a chronic myelitis, and one traumatic neurasthenia. The general symptoms as given in the cases certainly suggest the condition described by Mitchell as erythromelalgia, though in one or two the features were rather those of vasomotor paralysis. Collier lays a good deal of stress upon the value of the existence of this symptom in the diagnosis between functional and organic disease. He suggests the following explanation:

"In several of my cases there occurred at first only spontaneous attacks; afterward the conditions became frequently induced by the dependent posture, and later a condition of permanent vasomotor palsy of greater or less degree made its appearance, the attacks meanwhile continuing. This sequence suggests an irritative lesion of nerve-structures governing the bloodvessels being the cause of the vascular crisis and of the progress of this irritative lesion to a partially destructive lesion being the cause of the

persistent vasomotor palsy; these phenomena in vasomotor nerve elements being parallel with pain followed by anæsthesia in sensory nerve elements and with spasm followed by motor paralysis in motor elements. Weir Mitchell used the term 'vascular storm' in reference to this condition, and the term 'vascular crisis' would, I think, be very apt, occurring as it does in tabes associated with gastric and other sensory 'crises.' Probably the same fundamental pathological processes underlie both sensory and vascular crises. In all my cases the vascular change was never preceded by the sensory disturbance, but either preceded it or the two appeared simultaneously. It seemed as if the sensory disturbance was a local result of the altered vascular condition of the part. I would lay stress on the fact that erythromelalgia may be the first symptom of organic disease of the cord, and may be of great value in diagnosis, and especially valuable in the differential diagnosis between functional diseases and disseminated sclerosis."

The Mosquito and the Malarial Parasite.—At the recent meeting of the British Medical Association in Edinburgh, PATRICK MANSON (*British Medical Journal*, September 4, 1898) read a most interesting communication on the malarial organism and the possibility of the mosquito being the intermediate host of this parasite. He first gives a brief account of the life-history of the human plasmodium malariæ. Special reference is made to that octopus-like organism commonly known as "the flagellated body," with its two to six actively moving flagella. As this organism is never seen in the freshly drawn blood specimen, and as it appears only after the blood is allowed to stand for some considerable interval, Manson believed that it served some purpose outside the human body. As it is impossible for the organism from which this flagellated body develops to escape from the human body by itself, he looked about for some agent by which this could be effected. After due deliberation, he concluded that this agency was the mosquito, being doubtless influenced by the part which he had found this parasite to play in the transmission of the filaria sanguinis hominis.

Manson believed that the latent parasite is sucked up by the mosquito, in the stomach of which it afterward becomes flagellated. He further thought that the flagella, after breaking off from the central sphere, by virtue of their inherent locomotive power penetrate the mosquito's stomach and enter some cell, and there start the extracorporeal life of the malarial parasite.

Whereas this was at first mere conjecture, the correctness of the theory was in part substantiated three years ago in India by Surgeon-Major Ross, who actually found the flagellated bodies in the blood contained in the mosquito's stomach after biting an infected patient. Two years later Ross actually discovered the pigmented extracorporeal parasite developing in the stomach-wall of "dappled-winged" and gray mosquitoes.

At first it seemed difficult to explain the occurrence of pigment in the parasites found in the stomach-wall when no pigment is contained in the flagella. McCollum's important observations on the halteridium, a parasite of birds, offered an explanation on this point. He observed that quite commonly free flagella fertilized a certain type of the organism in the bird's blood, the product being a very actively moving vermiculum, which was very destructive to red and white corpuscles with which it came into contact.

Manson believes it probable that an analogous process occurs in the mosquito's stomach and that a similar organism is produced which is able to penetrate the stomach-walls.

Recently Ross has made observations in Calcutta on the proteosoma, another parasite of birds. He conducted two series of experiments. He first fed gray mosquitoes on the blood of sparrows infected with the proteosoma, and always in a few days found pigmented parasites in the stomach-wall. He then fed the mosquitoes on the blood of sparrows not infected, and in every instance the examination of the mosquito was negative. In the positive cases he found the stomach-wall studded with numerous parasites which protruded into the general body cavity of the insect after six or seven days. To the organism at this stage he gave the name "proteosoma coccidium." Ross found in certain mosquitoes, particularly in those in which the protruding proteosoma coccidia had ruptured, numerous spindle-shaped bodies scattered through the body cavity and tissues of the insect. He designated these bodies "germinal rods." He afterward definitely determined that these rods were derived from ruptured organisms, and were actually the progeny of the coccidia. He believes that these rods are distributed throughout the insect by way of its blood circulation.

In dissecting the tissues of mosquitoes Ross discovered that the insect was provided with a peculiar veneno-salivary gland, one on either side of the head, and both emptying by a common duct into the proboscis. In the clear, plump cells of this gland he found enormous numbers of the proteosoma germinal rods. Ross strongly suggested that it was in this salivary secretion that the parasite left the mosquito's body. To test this point he allowed mosquitoes whose salivary glands he knew contained these germinal rods to bite sparrows in whose blood microscopic examination had shown there were no proteosoma. After some days he was gratified to find that the sparrows' blood contained innumerable parasites.

This suggestive discovery Manson thinks has a very important bearing on the part the mosquito may play in the transmission of malaria in the human subject.

PÆDIATRICS.

UNDER THE CHARGE OF

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Goitre in a New-born Infant Cured by Thyroid Treatment of the Mother.—MOSSÉ communicated to the Académie de Médecine, April 12, 1898 (*Revue mensuelle des Maladies de l'Enfance*, June, 1898), the case of a weak, cachectic new-born infant presenting a marked bilobed goitre. The mother, herself goitrous, was in excellent health, but mentally weak. The treat-

ment of the mother consisted in the daily administration of one and one-half grammes of thyroid body. At the end of a month and a half her goitre had almost totally disappeared, and in the infant the cure was complete. A later course of treatment considerably improved the general condition of the baby.

The Pupillary Reflex in Infectious Diseases.—COSTE, of Marseilles (*Congrès français de Médecine interne*, April 12–16, 1898), has found that the pupillary reflex remains normal in measles, variola, and scarlatina; it is more or less abolished in primary hemorrhagic variola. In typhoid fever, if a pulmonary complication arise, the reflex is diminished; in infectious endocarditis it may be completely paralyzed, and in cholera its absence is of fatal significance.

The Role of Secondary Infections in the Hemorrhagic Forms of Eruptive Fevers.—HAUSHALTER and ÉTIENNE (*Revue mensuelle des Maladies de l'Enfance*, June, 1898) have found that in variola hemorrhagic complications appear to be due to a secondary infection of the streptococcus. This organism has been found in pure culture in the blood and viscera of a child dead of a hemorrhagic septicæmia appearing at the period of pustulation. The disease had been contracted in the hospital during convalescence from diphtheria. But the most important argument for this view was found in a distinct dissociation observed to exist between variola and hemorrhagic streptococcic septicæmia, as instanced in a child affected with a discrete and very benign variola, developing normally; during the convalescence fatal hemorrhagic complications occurred as the result of the removal of the patient during the first period of the disease to a ward in which hemorrhagic cases of the disease were being cared for. Moreover, the hemorrhagic form appeared to be independent of previous vaccinations. The authors conclude that in variola a mixed or secondary hemorrhagic streptococcic infection may occur.

A generalization of these conclusions with reference to other infectious diseases was offered by a case showing a hemorrhagic staphylococcic septicæmia during the desquamative stage of scarlatina.

Treatment of Infantile Syphilis by Hypodermatic Injections of Mercury.—FEDTCHENKO (*Semaine Médicale*, 1898, No. 9) has made a number of trials of the hypodermatic method of treating acquired or inherited syphilis in children, with very satisfactory results. The solution used was composed of fifteen centigrammes each of benzoate of mercury and chloride of sodium in fifteen grammes each of glycerin and distilled water. Of this two divisions of the ordinary Pravaz syringe, or one milligramme of the mercurial salt, are given to infants of one month, three divisions to those aged two or three months, four to those aged from four to six months, and five to those between seven months and one year. With children of more than one year the strength of the solution is doubled, and three to six divisions of the syringe injected, according to age. The injection is repeated every three or four days. According to Fedtchenko's observations, this treatment has always been well supported and has never provoked general disturbance, stomatitis,

or digestive trouble. At the point of injection there has been no inflammatory reaction or induration. The buttocks have been found to offer the most satisfactory region for injection, and four insertions can readily be made on each side, the solution being thrown deep into the muscles.

The therapeutic results have been most favorable. Recent macular eruptions have disappeared after three or four injections, papular and ulcerous syphilides after six or seven, and gummous lesions after nine or ten. The treatment is continued until complete disappearance of every manifestation of the disease, and is then suspended for from three to five weeks, after which six to eight injections are made. The child is then kept under observation for at least three months. Relapses have never been observed.

Changes in the Peripheral Lymph-glands in the Chronic Gastro-enteritis of Nurslings.—FRÖHLICH (*Jahrbuch f. Kinderheilkunde*, 1898, Band xlvii. S. 20) calls attention to the frequency of adenitis, especially of the inguinal glands, in chronic gastro-enteritis. These swollen glands vary in size from that of a lentil to that of a cherry; they are elastic and disposed in chains, in general resembling the adenopathy provoked by syphilis.

Histological examinations were made by the author in twenty cases in which the children during life presented no other general disease or local affection; none of the glands were tuberculous. In five cases there was simple hyperplasia; in three hypertrophy of the follicles; in one cirrhosis, with considerable increase of the interstitial connective tissue; in six multiple hemorrhagic foci; and in five a degeneration with necrosis similar to that observed in diphtheria. In no case were micro-organisms found in these ganglia.

The author attributes this adenitis to a special effect of toxins elaborated in the intestine.

A Grave Intestinal Infection of Infancy.—TOMMASI (*Journal de Clinique et Thérapeutique infantiles*, 1898, No. 18) describes a grave epidemic disease which he has observed for several years in and about Naples during the summer season. The symptoms in general present the following characteristics: The disease begins with a simple gastro-intestinal catarrh, in which uncontrollable vomiting is a marked feature. The tongue is never typhoid in appearance, and the spleen is not enlarged. Gradually the nutrition fails and the nervous system shows evidences of depression or of excitation (persistent blepharospasm, eclampsia, convulsions of Jacksonian type, mydriasis, myosis, meningism). The fever is of no distinct type; it presents rapid and transitory elevations, sometimes is wanting altogether. Various cutaneous eruptions, scarlatiniform, rubeolic, or papular in type, with petechiæ or furuncles, have been observed at all periods of the disease and with variable distribution, preferably upon the trunk. Perspiration is abundant, as is also diuresis at the beginning; but later, with the aggravation of the disease, the urine diminishes and eventually is suppressed.

As complications, angina, thrush, broncho-pneumonia, and otitis have been observed. Autopsy has shown slight alterations in the intestines, the liver slightly enlarged, the spleen and nervous system normal. The duration is variable and the prognosis is always grave. Hot weather and errors of diet appear to play the principle rôle in etiology. According to the

bacteriological researches, the author concludes that the colon bacillus is the principal agent, since it has been found constantly in the stools in large numbers. The variability of the clinical picture depends upon the association with other bacteria, among which are the bacillus subtilis, the proteus, staphylococci and streptococci.

[The author has given a very easily-recognized picture of the grave forms of milk-infection of hot weather, with which all American observers are thoroughly familiar.]

The Enanthem of German Measles.—FORCHHEIMER (*Pediatrics*, July 1, 1898), at the recent meeting of the American Pediatric Society, described as characteristic of this disease an enanthem which he has been led by observation to believe must be present in all cases. This is a macular, distinctly rose-red eruption upon the velum of the palate, the uvula, extending to but not onto the hard palate. These spots are arranged irregularly, not crescentically, are the size of large pinheads, and are very little elevated above the level of the mucous membrane. In twenty-two cases in which the eruption was studied there was no instance of the exanthem with which there was not present a suggestion of the enanthem. It is, however, very short-lived, and fades away within the first twenty-four hours, and then appear certain results of involution, not present in the majority of cases.

It is the same eruption found upon the skin, characterized by the size of efflorescence, its arrangement, the absence of great infiltration, and, above all, by its color, a pure pinky rose-red, almost exactly the same as the roseola of typhoid fever. During involution pigmented deposits are sometimes left, usually of a yellowish or yellowish-brown color, either in spots or in streaks.

The claim of distinctiveness is supported by comparison with the enanthem of the two diseases with which rubella is confounded. In scarlatina it appears from twelve to twenty-four hours before the eruption, upon the pillars of the fauces, in the form of the characteristic puncta, then rapidly spreading over the mouth in the form of a scarlet-red coalescing eruption, which finally ends in desquamation, producing the strawberry tongue, and lasting well into the second week of the disease. In measles the enanthem begins upon the soft palate from thirty-six to forty-eight hours before the exanthem, in the form of purplish or bluish papules, arranged crescentically, and extends over the cheeks, accompanied by the blue tongue. It is at its maximum with the beginning of the eruption, and may take as long as three to four days to disappear.

In conclusion, the author stated that these studies were made in one epidemic only, and their verification must rest with the study of other epidemics before they can be accepted as belonging to all cases of rubella under all circumstances.

Dr. Fruitnight had found the sign described by Dr. Forchheimer in more than 70 per cent. of the cases, and was inclined to think it a diagnostic test. In concluding the discussion Dr. Forchheimer stated that the spots in German measles did not increase in size. When they appeared they came out in their largest circumference, and then there took place a process of involution which sometimes in very pale mouths led to pigmentation, just as pigmentation may occur in the skin.

SURGERY.

UNDER THE CHARGE OF

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Diagnosis and Treatment of Spasmodic Stricture of the Œsophagus.—RUSSELL (*British Medical Journal*, June 4, 1898) reports seven cases of this character that have come under his personal observation; he does not believe they are as rare as commonly supposed. This is that stricture which is situated at or near the cardiac orifice of the stomach, and is caused by muscular spasm, superimposed upon a greater or less degree of more permanent contraction.

The apparent rarity of the disease the author believes to be due, in the first place, to the misleading character of the symptoms, suggesting, as they do, disease of the stomach; and, secondly, to the inefficacy of treatment by bougies in this condition, causing a diagnosis of stricture, once made, to be abandoned or modified, since the symptoms persist after supposed dilatation. As to treatment, that which the author has used with success consists in stretching the stricture, by an expanding dilator, to a calibre approaching that of the normal œsophagus at that point. This is not done suddenly at one operation, but with bags of increasing size and at several sittings. Four cases were completely cured by this means, one was much improved, and one was not improved.

The author suggests: That in all cases of persistent vomiting, unless obviously due to disease of the stomach, it should be positively ascertained whether or not a stricture is present; and that it should not be assumed that no stricture or spasm exists because none can be detected by a bougie, nor that stricture is not the cause of the symptoms because these persist after the largest bougie has been passed. In cases of doubt the behavior of food given through a tube may be of assistance. In using instruments for the diagnosis or treatment of stricture it is very easy to be deceived on the question as to whether they have passed into the stomach or not; measurement of the length passed in is no infallible guide. In using the dilator the author always passes it well below the point required, and then withdraws it until it is in the stricture before expanding.

The Surgical Treatment of Pyloric Obstruction.—In treating of the various forms of pyloric obstruction, PAUL (*British Medical Journal*, June 4, 1898) says that of the three operations used in the treatment of fibrous strictures of the pylorus, divulsion, pyloropasty, and gastro-enterostomy, the

former is unsatisfactory and must give place to the other two. Pyloroplasty is the best operation, but, unfortunatly, it is not applicable to all cases. When the parts are sufficiently yielding to permit a broad band of healthy mucous membrane to be drawn into the contracted pyloric orifice, the result is perfect—better, he thinks, than is ever obtained by any other stomach operation. When, however, it cannot be done in this manner gastro-enterostomy is distinctly the better operation. Moreover, when active ulceration is present, it is generally undesirable to operate in its immediate neighborhood. Pyloroplasty is probably a less severe operation than gastro-enterostomy, but this need be considered only in exhausted subjects, when pyloroplasty should be done, if possible.

For malignant stricture there are only two operations, pylorectomy and gastro-enterostomy, unless some pyloroplasties for obstruction, where only part of the pylorus was involved, should prove to be successful.

Pylorectomy should be reserved for favorable cases. A gastro-enterostomy is the most that a person in an exhausted condition can be expected to survive. In other cases the extension of the growth places a limitation on the form of operation. Attempts at total excision of the stomach should be very few, and pylorectomy should only be attempted when the growth is very small, and, above all things, freely movable. The preferable form of operation is to unite the cut ends, but where this is impossible they should be closed and a gastro-enterostomy performed. The author has some doubt regarding the choice between simple suture and suture combined with a button or bobbin; he inclines toward the former, when approximation is easy. When there is any difficulty in applying the sutures the posterior ones are in danger of proving insecure, and here the button is an advantage.

Of gastro-enterostomy, the author says its greatest failing has always been a high mortality, due, no doubt, to the exhausted condition of the patient at the time of operation. As a matter of fact, mechanical appliances and simple suture are both very well in their way, and succeed in the right sort of patients, but are not suitable for exhausted subjects. The dangers are increased by their low vitality, and the mechanical support becomes a source of danger. As a foreign body, it lies in contact with the wound, and, in case of the button, about the sixth or seventh day perforation is liable to occur, with extravasation of the gastric and intestinal contents into the peritoneal cavity, and rapid collapse and death. Plain suture has difficulties and dangers quite as great. The time occupied in effecting a water-tight union, the greater danger of contaminating the peritoneum during the operation, and the subsequent tendency which the opening shows to close are substantial objections to this mode of operating. At present the choice lies between rapidity and primary security of the button and the slowness and less perfect primary security of the suture operations. They are neither operations for exhausted subjects. The author proposes the following operation, trusting it may suggest some better if it is not perfect in itself.

"The bowel and stomach having been exposed, a longitudinal incision is made in the former for two inches in the human subject, through the peritoneal and muscular coats only. These are reflected with a small, curved, blunt dissector over an oval area having a diameter of one inch in the centre. The exposed submucosa in then rubbed with a stick of zinc chloride,

say half a dozen times, being well dried between each application, when it assumes a gray, dead look. The bowel is now wrapped in a piece of moist absorbent wool and laid on one side, while the stomach is dealt with in an almost similar way. In preparing the stomach for the anastomosis, instead of making a linear incision, an oval patch of musculo-peritoneal coat is excised; the muscular coat being so much thicker in this organ, it is rather in the way if only reflected, and, what is of more importance, the loss of substance helps to prevent subsequent contraction of the opening. Both of the wounds having been duly cauterized, they are brought together, and a continuous suture of the finest green gut or silk is run around the edges, not, of course, penetrating the mucous membrane, but picking up as far as possible the tough submucous coat. Finally, a few Lembert sutures or Halsted sutures are generally desirable, especially in anterior gastro-enterostomy.

The operation has been successful in dogs, a sloughing taking place in forty-eight hours and establishing the anastomosis after good firm union has taken place.

The features of the operation that the author hopes may be reckoned advantages are:

1. The effect is one of pure traumatism. The viscera not being opened, all risk from such sources is avoided.

2. No foreign body is used.

3. The time occupied is less than for a suture operation though more than for Murphy's.

4. The anastomosis resulting from loss of tissue should be more durable than in the majority of methods.

The complete absence of shock in the experimental cases was a noticeable feature as compared with other cases done by other methods. There was much less pain.

The author also briefly reports a series of twenty cases of operation for pyloric obstruction.

The Action of Sympathicotomy on the Exophthalmia and Tachycardia in a Case of Exophthalmic Goitre.—COMBERMALE and GAUDIER (*Gaz. Hebdom de Méd. et de Chir.*, April 24, 1898) report an interesting case in which Jaboulay's operation produced the following results. The patient was a female in whom, for some unknown reason, a goitre began rapidly to increase in size and was accompanied by exophthalmia, tachycardia, and all the symptoms of hyperthyroidization. No medicine appeared to have any effect; the heart could not be calmed, and its increasing action threatened the life of the patient. Recourse was had to section of the cervical sympathetic. The results were: 1. An immediate diminution in the exophthalmia. 2. A decrease of the pulse during a week from 200 to 100 per minute, and at the same time the disappearance of præcordial pain. 3. Absence of any modification in the goitre itself.

The cessation of palpitation, the lessened dyspnœa and disappearance of angina caused sufficient relief to make the patient satisfied with the operation, while the disappearance of the tachycardia and of the other dangerously threatening symptoms recompensed the operators.

The sudden drop in the pulse the authors would ascribe not to any direct

action or to action through the contiguity of these nerves to nerves about the heart; it was delayed in appearing, and did not take place immediately. They agree with Werthimer in believing that the thyroid fibres of the sympathetics after the section of the main trunk cease presiding over the activity of the thyroid secretion which causes the tachycardia, and that the rapid action of the heart ceases because the cause is thus stopped.

The fact that the goitre did not decrease in size would tend to show that the operation had no effect on the colloid matter excreted. In the normal state both vary in the amount physiologically secreted. We see small goitres that produce hyperthyroidization, and it is perfectly admissible to suppose that the section of the sympathetic may prevent the secretion of the toxin without interfering with the secretion of colloid material.

If this is true, the section of the sympathetics in cases where exophthalmia and tachycardia are the menacing symptoms is the operation of choice.

THERAPEUTICS.

UNDER THE CHARGE OF

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Urtica Dioica.—M. HJALMAR AGNÉR, under the title of "Forgotten or Neglected Medicinal Plants," recommends this as depurative, diuretic, and a galactogogue. An infusion made from the roots and stems, freshly collected in spring, is an excellent remedy for the anæmia so often met with in early spring.—*Bulletin Général de Thérapeutique*, 1898, 21e liv., p. 801.

[The stinging nettle has been chiefly used as an astringent in uterine hemorrhage.—R. W. W.]

The Treatment of Chlorosis by Hot Baths.—DR. ROSIN, failing with regulation diet and the administration of drugs, as iron and arsenic, has made use of baths, of fifteen minutes' duration, at a temperature of 89.6° F., thrice weekly. Each bath is followed by a short cold affusion. Cure was obtained in four weeks in more than fifty instances which had been under observation.—*Klinisch Therapeutische Wochenschrift*, 1898, No. 17, S. 575.

The Treatment of Gastric Ulcer.—M. FRÈMONT regards gastric hyperacidity as the principal causative factor. The first indication is to relieve the gastric juice of its digestive activity. For this two methods, which are readily combined, present themselves: Milk fixes the hydrochloric acid; the alkalies neutralize it. The neutralized juice does not digest. The second indication is to cover the surface of the ulcer so as to prevent contact with the gastric juice. To neutralize a fluid which is constantly being secreted, frequent doses are necessary. For instance, two or three tablespoonfuls of warm (100.4° F.) milk are given every thirty minutes for twenty

consecutive hours, to which a grain of calcined magnesia, a grain of prepared chalk, two grains of bismuth subnitrate, and four grains of sodium bicarbonate are added. During the remaining four hours of the night this dose is given every hour. The amount may even be increased if the pain is not relieved. If there is repeated hemorrhage, ice should not be given internally, but an ice-bag upon the stomach is beneficial.—*Bulletin Général de Thérapeutique*, 1898, 23e liv., p. 909.

The Action of Sodium Chlorate upon Hyperchlorhydria.—M. SOUPAULT prescribes this drug in the daily amount of two drachms, in from two to four doses, as far as possible from meal-times. The results have been remarkable with all patients suffering from hyperchlorhydria, whether or not complicated by ulcer. In the paroxysmal crises relief is rapidly obtained; the remedy clearly diminishes the gastric secretion without modifying its quality. The drug should not be given if there is reason to suspect any renal disease.—*Revue de Thérapeutique Médico-Chirurgicale*, 1898, No. 13, p. 445.

Thallium Acetate as a Remedy for the Nocturnal Sweating of Phthisis.—DR. H. HUCHARD, in commenting upon a paper presented by Combemale before the Paris Academy of Medicine, calls attention to the disadvantages of this drug. Given as a pill in dose of one and one-half grains—in one instance in double this quantity—it was efficacious, when administered one hour before the expected sweating, in all periods of the disease. Often a single dose sufficed; rarely was it necessary to continue it for more than seven days. If it did not produce the desired effect within four days, it was useless to continue it. Although this remedy possesses toxic properties, these were not encountered during the ingestion of therapeutic doses. The contraindication to this drug is the alopecia which it produces, so marked in one instance that total baldness followed the administration of a dozen pills. The question is raised as to its effect locally applied, and whether it does not enter into the composition of depilatory pastes.—*Les Nouveaux Remèdes*, 1898, No. 12, p. 265.

The Treatment of Hepatitis.—MR. JAMES CANTLIE states that the first essential is rest, and the object of this is to prevent the diaphragm moving over the top of the liver. The patient must be placed in the horizontal position. To fix the lower part of the chest, strapping is an excellent means. Hot fomentations, or a very large poultice changed every three hours, are useful. Local application of nitro-hydrochloric acid is a favorite remedy; it is thought that baths of this do not possess any specific virtue. As for food, milk is admissible only in the form of whey; starchy foods must be withheld, while animal food in its most digestible form is the keynote of successful dieting. Only enough to support life ought to be given, so long as acute symptoms remain. Raw-meat juice, raw meat itself, chicken-soup, and weak beef-tea should form the elements of diet. As drinks, hot water and weak, freshly-made tea with lemon are the best. As the acute symptoms subside, the "meat" nourishment may be increased, and the first starchy food to be administered ought to be well-steamed rice. To clean out

the bowels calomel is the best drug to use; three grains given on an empty stomach is the best form. If the bowels are not freely moved after twelve hours have passed, sodium sulphate, the effervescing salt, a half ounce in a small quantity of water, is recommended. Acids and alkalies should be avoided. Ammonium chloride in twenty-grain doses, either alone or in combination with potassium iodide and bromide, may be made into a mixture in conjunction with taraxacum. When pus is suspected, aspirate, tap, and drain. The danger to the lung or diaphragm from tapping should not be considered.—*The Clinical Journal*, 1898, No. 295, p. 161.

Enteric Fever in India.—Dr. Richard H. Quill considers the treatment of this disease on the antiseptic principle. He has treated forty-six patients, of whom two died. This mortality (4.3 per cent.), as compared with the usual average in India, which is seldom below 20 per cent., is gratifying. For the treatment no more milk—and even that, if necessary, is peptonized—is given than can easily be assimilated. All milk is to be boiled, and to each pint is added one ounce of an alkaline mixture consisting of sodium bicarbonate, 4; sodium chloride, 1; in water, 96. Nourishment (this and beef-tea or chicken-broth) is given at regular intervals, immediately followed by the antiseptic mixture. If there is distention of the abdomen or blood in the stools, an ice-poultice suspended in a tray which is attached to a surgical cradle is kept constantly in apposition to the abdomen. If the patient comes under observation during the first week, two grains of calomel at night, with one the next morning, are given on the first day. The antiseptic employed is: Pure carbolic acid, 1; compound tincture of chloroform, 4; compound tincture of cardamom, 4; syrup of orange, 16; chloroform water to 192. Of this one ounce, with an equal quantity of iced water, is taken every second or third hour, immediately after food—that is, from five to ten doses each day, according to the severity of the disease. After the temperature has fallen to normal, from three to five doses should be given each day for at least a week in order to prevent relapses. In no instance were unpleasant effects noticed. A second prescription, which has been found equally useful when its flavor has not been objectionable, is: Oil of eucalyptus, 1; mucilage of acacia, 8; aromatic spirit of ammonia, 4; glycerin, 2; spirit of chloroform, 2; chloroform water, 96. Of this an ounce is to be administered every third or fourth hour. The effects observed, and which are ascribed to the treatment pursued, are as follows: (1) Intellectual clearness of the patient, with very slight tendency to delirium or stupor. (2) Food invariably well assimilated. (3) Abdominal distention, except to a very moderate extent, invariably absent. (4) Early cleaning and moistening of the tongue; dryness very rarely present. (5) Stools almost completely deodorized. (6) An offensive odor from the breath or body of the patient rarely observed. (7) Tendency to undue looseness of the bowels rarely present. (8) Secondary complication of any kind never noticed. (9) The fever pursued its course "kindly," with little distress to the patient. (10) Convalescence rapid and complete. The author was unable to satisfy himself that: (1) The duration of the fever was lessened. (2) There was any marked and continuous lowering of the thermometric range, or (3) that an occasional tendency to relapse was removed.—*British Medical Journal*, 1898, No. 1950, p. 1254.

GYNECOLOGY.

UNDER THE CHARGE OF

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Vaginal Hysterectomy without Forceps or Ligatures.—TUFFIER (*Revue de Gynécologie et de Chirurgie Abdom.*, 1898, No. 4) reports twenty-seven cases of vaginal hysterectomy operated upon by the following method: The uterus is first freed from adhesions, is bisected in the usual manner, and one-half is drawn out of the vulva. The finger is passed behind the upper part of the broad ligament and the included tissue is grasped between the jaws of a powerful clamp, called the *angiotribe*, which is tightly screwed: The tissues are thus destroyed and the ovarian artery occluded. The lower portion of the ligament is then seized with the instrument, guarded by the finger as before, and the included tissues with the uterine artery are similarly compressed. The same procedure is carried out on the opposite side. The uterus is thus detached and can easily be removed without fear of hemorrhage. In short, the same technique is employed as in an ordinary clamp-operation, except that the clamps are not left in position. In complicated cases, in which morcellation of the uterus is necessary, the broad ligaments are first secured with clamps, which are removed in time from below upward after the included tissues have been caught and crushed with the angiotribe. Two cautions are added in using the instrument—to screw the handles as tightly as possible and to keep the blades in the axis of the vagina, so as not to tear the tissues outside of their grasp. In none of the reported cases did any accident occur during the operation, the absence of hemorrhage being especially noted. The author believes that this method is applicable to any case in which vaginal hysterectomy is indicated.

Chelidonium Majus in Inoperable Carcinoma of the Uterus.—FREUDENBERG (*Centralblatt für Gynäkologie*, 1897, No. 30) reports the results of experiments in Landau's clinic. He used tampons saturated with a 50 per cent. solution of the extract every day or every second day. The applications were painless and caused no general disturbance. The growth of the disease toward the vaginal roof was arrested, the foul discharge was lessened or ceased, and, in a few instances, the hemorrhages were checked. While in no sense a curative, the remedy seemed to have a decided palliative effect.

WINTER and SCHMITT (*Ibid.*) report fourteen cases of inoperable carcinoma treated with chelidonium. About twenty minims of the aqueous extract were injected subcutaneously in three or four places in the abdominal wall; it was also administered internally in daily doses of from twenty to sixty minims. The injections were very painful. It seemed to improve the digestion, but had no influence whatever upon the progress of the disease.

Menorrhagia at the Menopause.—ORLOFF (*Wratch; La Gynécologie*, 1898, No. 2) employs intra-uterine injections of equal parts of a solution of

alumnol in alcohol and tincture of iodine (each 50 per cent.), after previous thorough disinfection of the vagina. The result of this treatment in every instance was to arrest or diminish the hemorrhage, menstruation afterward recurring normally. The results are less marked in cases of fibroids, although the bleeding is certainly checked. The injections are usually repeated at intervals of two or three days, the patient being kept in bed for at least two hours afterward.

Administration of Ovarian Extract.—JAYLE (*Revue de Gynécologie et de Chirurgie*, 1898, No. 4) concludes a supplementary paper on this subject as follows: Ovarian opotherapy is really the practical application of the general theory advanced by Brown-Séquard with regard to the internal secretion of the ovary. It has now met with such success in the hands of various experimenters as to warrant the belief that the cases in which beneficial results have followed are not mere coincidences. Ovarian extract certainly acts directly for the relief of the disturbances attending the climacteric, both the natural and the artificial. It is also indicated in amenorrhœa, dysmenorrhœa, and anæmia of ovarian origin. The writer has also noted good results in the treatment of some cases of oöphoritis. As a result of the careful study of this subject, gynecologists have been led to recognize the important relation of the ovarian function to the general health, and hence have become more generally conservative in their operations upon the adnexa.

Importance of the Omentum in Abdominal Operations.—CORNIL and CARNOT (*Bull. de l'Acad. de Méd.; La Gynécologie*, 1898, No. 2) describe a series of interesting experiments on dogs, from which they draw certain practical inferences with regard to the protective action of the omentum. It is not necessary to draw it down over a raw surface, since its natural tendency is to seek such a surface and to become adherent to it. In the same way it attaches itself to an inflamed organ within the pelvis and serves to wall off purulent foci from the general cavity. In tubercular peritonitis it becomes attached to the abdominal wall and acts as a diaphragm, shutting off a collection of purulent fluid below from healthy tissue above.

Pseudomembrane in Vesico-vaginal Fistula.—LIONVINOFF (*Journ. d'Obstet. et de Gyn.*, 1898, No. 2) has examined bacteriologically the so-called diphtheritic membrane which forms around the edges of vesico-vaginal fistulæ. In every instance he found the *bacterium uveæ* of Leube, as well as small, rod-shaped organisms with rounded ends, which liquefied gelatin and gave a green color in agar. The latter were evidently the *bacillus pyocyaneus*. He infers that these may not only develop in a suppurating wound, but, by penetrating more deeply, may give rise to obstinate local infection.

Necrosis of the Vagina.—BARSONKOFF (*Soc. d'Obst. et de Gyn.; La Gynécologie*, 1898, No. 3) reports a case of sulphuric-acid poisoning in which, eight days after her entrance into the hospital, the patient had a slight vaginal hemorrhage. A few days later, without having had any elevation of temperature, she passed a large slough representing a complete cast of the

vagina. This included the entire thickness of the vaginal wall and some of the subjacent connective tissues. No cause could be discovered, the patient firmly denying that anything had been introduced into the vagina. The writer cites three similar cases of sloughing of the vagina occurring during the fourth week of typhoid, when the temperature was declining. In these cases, as well as in the one reported, in spite of the extensive loss of tissue, no marked contraction of the canal was noted.

Pathological Anatomy of the Fallopian Tubes.—LINGUEN (*Journ. d'Obstétrique et de Gynécologie*, 1898, No. 2) concludes, from examinations of a number of diseased tubes, that the tube is not simultaneously infected throughout its entire length, but that the infection begins at the abdominal end. Each tube may be the seat of a different infection at the same time; thus, a simple catarrhal salpingitis may exist on one side and a pyosalpinx on the other, no difference in the secretion being revealed by the microscope. While gonorrhœa and puerperal infection are the most frequent cause of salpingitis, it is not always easy to find the characteristic micro-organisms, probably because the latter often succumb to their own toxins, so that the pus becomes sterile.

Painful Intraperitoneal Adhesions. — NOVÉ-JOSSER and GOINARD (*Journ. de Méd. et de Chir.*, April 25, 1898) describe, under this head, slight adhesions resulting from localized peritonitis following lesions of the alimentary canal or accompanying affections of the female pelvic organs. They may give rise to no symptoms whatever, but usually some neighboring organ is more or less affected. Pain is most often present, persistent, well localized, and increased on deep pressure, but it is not colicky in character. At other times the pain may be dull, with occasional paroxysms, suggesting hepatic or renal colic. The paroxysms may coincide with the periods of physiological activity of the abdominal viscera. Constipation is more or less marked if the intestines are adherent, due not so much to occlusion of the gut as to exaggerated peristalsis.

Certain obscure vesical troubles are doubtless due to adhesions of the bladder.

The diagnosis is exceedingly difficult, often impossible without resort to an explorative incision, but the presence of adhesions may be suspected in the presence of persistent localized pains following an attack of peritonitis or a cœliotomy. It is important to exclude hysteria, especially if operative interference is contemplated.

Operations on Fibroids After the Menopause.—PICQUÉ (*La Gynécologie*, April 15, 1898) emphasizes the fact that there is an erroneous idea that the pathological history of fibroids terminates with the establishment of the climacteric. On the contrary, it may only begin at that time. He cites three illustrative cases in which it was necessary to perform hysterectomy in women after the menopause, once for intestinal obstruction, and twice for acute inflammatory attacks ending in pelvic suppuration. In one of the latter the condition was rendered much worse by the use of electricity.

It is important, he adds, that a fibroid should be kept under observation throughout the patient's life, since, even if the tumor itself does not give rise to trouble, complications on the side of the adnexa are to be apprehended.

OBSTETRICS.

UNDER THE CHARGE OF

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Œdema of the Placenta and Fœtal Leucæmia.—In the *Monatschrift für Geburtshülfe und Gynäkologie*, Band viii., Heft 3, SIEFART reports an interesting case in which a mother suffered from nephritis of pregnancy, albumin and casts being found in her urine. Her blood showed the red corpuscles to be clear in appearance, with increase in the white. The amount of urine was scanty.

The patient came into labor while preparations were being made for its artificial induction. Her child was born spontaneously. Under appropriate treatment, the mother made a good recovery.

The child, from birth, showed well-marked œdema of the face and head, the eyes and nose being practically closed. The abdomen was greatly swollen and also the lower extremities. The amount of amniotic liquid was small. The child made feeble efforts to breathe, but did not live. On section the skin and the tissues beneath were full of serum, and the cavities of the body contained serum in abundance. The glandular organs were swollen and the glottis was also œdematous.

On examining the placenta it was found in three different portions. It was pale red, very fragile, the placenta and membranes being œdematous.

On microscopic examination, the villi were much increased in size and the spaces between the villi were very much diminished. These spaces contained no blood, while the connective tissue was much increased. Thrombosis had occurred in some of the vessels. The placenta did not resemble those usually found in cases of nephritis. The blood of the fœtus showed great increase in the number of white cells.

The whole clinical picture is that of the kidney of pregnancy in the mother, with œdema and extensive alteration in the placenta and blood of the child.

Two Interesting Cases of Ectopic Pregnancy.—In the *Monatschrift für Geburtshülfe und Gynäkologie*, Band viii., Heft 3, VOIGT reports an interesting case of ectopic pregnancy in which operation was undertaken to relieve an increasing hæmatoma. The patient perished of shock from continued

hemorrhage after the operation. A careful examination of the specimens and of the body of the mother showed that pregnancy had taken place in the fimbriated portion of the ovary and tube. This is an unusual occurrence, and its possibility is denied by some.

In the same journal and in the same issue SEREJNIKOFF reports a case of pregnancy in the rudimentary horn of a double uterus, in which abdominal section was performed in the hope of saving mother and child. The fœtus and appendages were removed and were found to have been contained in the rudimentary horn of a double uterus. The fœtal sac was packed with gauze and drained through the vagina. The peritoneum was stitched together above the gauze. The child unfortunately survived but a short time, and the mother made a tedious recovery, complicated by fever and by prolonged discharge through the vagina.

A Case of Extensive Tear of the Uterus and Vagina Occurring in Labor and Followed by Recovery.—VAN DER HOEVEN (*Monatschrift für Geburtshülfe und Gynäkologie*, Band viii., Heft 8) reports the case of a patient in tedious labor, during which the midwife in attendance thought she observed a change from a vertex to a shoulder presentation. Some time after version was done without anæsthesia, and the child delivered as far as the head.

When the reporter saw the case he found it comparatively easy to complete the delivery. On examination there was observed an extensive separation of the vagina from the uterus, the placenta and cord having escaped through the rent. The hand could be passed beneath the peritoneum and beneath the abdominal cavity. The placenta was found high in the abdomen near the liver. The appendages were removed, clots also being extracted, and the birth-canal tamponed with iodoform gauze. The patient made a good recovery.

Forty Cases of Puerperal Fever, with Bacteriological Examination of the Uterine Contents.—In the *American Journal of Obstetrics*, September, 1898, WILLIAMS gives the results which he has obtained from the study of forty cases of puerperal fever. He has adopted the rule of making cultures from the uterine cavity if the temperature of a hospital patient reaches 101° F., and in out-patient practice 102° F. Of these cases, twenty-two were delivered in the obstetric wards of the Johns Hopkins Hospital; eight in the out-patient department of the hospital, and ten cases were seen in consultation. Thirty of these cases were delivered by persons connected with the hospital, and the remainder by those who are not so connected.

His results were as follows: Streptococci found in eight cases; staphylococci in three cases; colon bacilli in six cases; gonococci in two cases; anäerobic bacteria in four cases; unidentified äerobic bacteria in three cases; bacteria on cover-glass, but cultures sterile, in four cases; diphtheria bacilli in one case; gas bacilli (bacillus aerogenes capsulatus) in one case; typhoid bacilli in one case; cover-glass cultures and blood sterile in eleven cases; cover-glass and cultures sterile, with malarial plasmodia in blood, in one case, making a total of forty-four cases.

Eleven of these cases were probably sapræmic. In one case there was found in the vaginal secretion before labor an organism apparently identical with that found in the uterus after labor. This offers very slight evidence in support of the doctrine of auto-infection. In a case of abortion which was not examined internally, the temperature rose to 103.5° F. on the eighth day, and fell after brisk purgation. In this case a non-pathogenic bacillus was found resembling that of the colon. In some cases intestinal auto-intoxication was probably the cause of the fever, and the germs found had nothing to do with it.

He calls especial attention to the value of bacteriological examination in eleven cases in which no pathogenic germs could be found in the uterus. Other causes were present which accounted for the fever. It is especially valuable to be able to exclude dangerous causes in the presence of puerperal fever. In a case of quartan malarial infection also a positive diagnosis was made by this method.

Milk Fever.—HEIDEMANN (*Monatschrift für Geburtshülfe und Gynäkologie*, Band viii., Heft 3), from his studies of milk fever, believes that it is distinctly the result of infection which usually has origin in the genital tract. He believes that the poison enters the circulation from the uterus, that it paralyzes the vasomotor nerves, and that the blood-supply of the breasts is so constituted that swelling of the breasts follows this paralysis. He calls attention to the fact that in other puerperal infections the breasts are often swollen, and notes the fact that the breasts are not usually red and that evidence of local inflammation in the skin is entirely absent. On the contrary, the symptoms of septic infection are strikingly present.

Acute Inversion of the Uterus.—In the *American Journal of Obstetrics*, August, 1898, STONE reports the case of a primipara, delicate, extremely nervous and apprehensive. Spontaneous delivery proceeded until the head reached the pelvic floor. Forceps was then applied under chloroform, and a good-sized child easily delivered. The cord was wound once about its neck. The perineum was torn and a gush of blood followed delivery, but immediately stopped. While preparing to suture the perineum, it was noticed that the patient had become pale and that the pulse became frequent. Bleeding had returned. An attempt was made to express the placenta, but the uterus could not be found through the abdominal wall. The placenta was found in the vagina, adherent to the inverted uterus, from which it was removed with considerable difficulty. The cord was of average length. The hemorrhage ceased and did not return.

The patient complained bitterly of pain and went into profound shock. Two efforts to replace the womb failed, and in half an hour the patient died.

In this case it is interesting to note the nervous condition of the patient, the complete absence of pain during the greater part of the stage of dilatation, the uterine inertia in the latter part of the second stage, difficulty in the removal of the cord from the neck of the child, and the adherent placenta. All these seem to have been factors in producing the inversion. The writer adds a table of twenty-four cases showing six deaths.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

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Lipoma of the Throat.—Dr. Volker reports a case from Czerny's clinic (*Beiträge zur klin. Chirurgie*, 1898, Band xxi., Heft 1; *Münch. med. Woch.*, 1898, No. 23) in which a large superficial lipoma, the size of a child's head, occurred in a girl, aged fourteen years, and extended along the entire lateral region of the throat under the sternocleido muscle and the anterior course of the carotid artery. It was composed of several larger or smaller masses adherent by an osseous pedicle to the fifth cervical vertebra. Closer examination revealed this osseous pedicle to be a rudimentary cervical rib about the extremity of which the lipoma had become developed.

Extirpation of the Thyroid Gland.—I. Messrs. Eugene Briau and Sargnon report (*Gaz. Hebd. de Méd. et de Chirurgie*, 1898, No. 52) an operation performed by Prof. Poncet, who removed an enormous cystic goitre of twenty-three years' duration from a male cretin, thirty-three years of age, and in whom, despite the intentional retention of some of the original thyroid substance, generalized myxœdema resulted.

This case was completely cured by the prolonged methodic use for three and one-half months of the thyroid preparation known as Baumann's iodothyrine—thirty centigrammes being given per day.

During the treatment M. Poncet introduced under the skin of the neck of the patient three small cubes of thyroid substance which he had just removed from a young girl, aged eighteen years. These massses were not well tolerated, the temperature becoming elevated and the wound in the neck becoming red and painful, so that it was necessary to withdraw the sutures and remove the necrosed masses. The thyroid treatment was then resumed uninterruptedly.

II. Mr. Colin Gray read at the Bendigo Branch of the Medical Society of Victoria (*Intercolonial Medical Journal of Australasia*, 1898, No. 5) some notes on a case of exophthalmic goitre in which he removed half of the thyroid gland from a female servant, aged thirty-one years. After the enucleation a careful search was made for the recurrent laryngeal nerve, and it was found that, with the exception of a piece about the thickness of a horsehair, the nerve had been torn across while dissecting out the gland. Some trouble was taken to find the two ends, the lower of which was eventually found in a ligature with a vein, and they were sutured with a finest Hagedorn needle and catgut.

With the exception of a little temporary hoarseness of about a week's duration, there was no evidence of injury to the voice. It is this phonic feature in the case that constitutes the chief point of interest.

Resection of the Trachea for Primary Tracheal Carcinoma.—Dr. P. von Bruns reports (*Beiträge zur klin. Chirurgie*, 1898, Band xxi., Heft 1; *Münch. med. Woch.*, 1898, No. 23) a case of tracheal carcinoma in a man, aged thirty-one years, who had suffered for ten years with gradually increasing difficulty in breathing. The growth was attributed to cancerous transformation of an intratracheal struma. The operative procedure consisted in the resection of the posterior and left wall of the trachea for a distance comprising ten tracheal rings. The patient's life was thus prolonged for six years.

Urticaria of the Throat.—Dr. M. B. Lederman reports (*The Laryngoscope*, September, 1898) a case of urticaria involving the soft palate and causing alarming symptoms, in which no involvement of the larynx could be noticed, the soft palate and uvula being so œdematous as almost to close the faucial space. Large wheals were present over the chest, abdomen, legs, and arms.

The patient, a man, aged thirty-eight years, had felt a jelly-fish strike against him while bathing in the ocean, and it is thought probable that this was the exciting factor in his attack.

On Injuries to the Turbinated Bodies by Forcible Insertion of Rigid Tubes in the Nasal Passages.—In a paper on "Injury to Inferior and Middle Turbinals in Operation for Deviated Septum," read by Dr. J. M. Stucky, of Lexington, before the American Rhinological, Laryngological, and Otological Society (*The Laryngoscope*, September, 1898), two cases are reported of injury to these bodies following what is known as the Asch operation.

In one case, in which the tube had been worn for five weeks, examination six months after the operation showed the interior turbinate to be fractured and bound down by adhesions to the floor of the cavity, completely obliterating the meatus, while the middle turbinate was tilted upward until it pressed against the septum, and, besides this, it was undergoing polypoid degeneration.

In the second case, seen two weeks after the operation, the inferior turbinate was bent, but not fractured, and was adherent to the floor of the cavity, while the middle turbinate was fractured and freely movable with the probe.

These conditions were attributed by the writer of the paper to injury by the tubes, which he thinks were too short, too wide, and too large at the external opening.

[In many instances the tube is not required at all. A thin sheet of flexible metal, bent U-shaped, and inserted so as to grasp the septum between the blades, will act as a splint and comfortably keep the refractured septum in its new position, as there is no muscular movement to disturb it, thus leaving both passages free for respiration without impediment from a foreign body pressing upon the turbinates. This is practically the method adopted by Dr. Asch in his earliest operations.]

Sarcoma of the Nasal Septum.—Dr. J. Payson Clark, of Boston, reports (*Annals of Otology, Rhinology, and Laryngology*, May, 1898) two cases:

I. A man, aged thirty-five years, was first operated upon in 1890, for round-celled sarcoma of the nasal septum, filling the left nostril. This was removed by cold-wire snare in several sittings. Recurrence took place from time to time, and in January, 1892, the whole septum was removed and found to be completely converted into an osteoid sarcoma. The disease was found too extensive for thorough removal. When last seen the patient was evidently dying from extension of the growth into the brain.

II. A married lady, aged forty-two years, had removed from her left nostril in June, 1897, a reddish-gray tumor of at least two years' duration, and which was found to be a myxosarcoma. There had been no evidence of recurrence nearly a year after the operation.

Adenosarcoma of the Nose.—Dr. Max Thorner, of Cincinnati, reports (*Annals of Otology, Rhinology, and Laryngology*, May, 1898) a case in a farmer, aged forty-seven years, from whose nasal passage masses were removed from time to time during a period of some eighteen months. At one time the histological investigation revealed typical adenoma, which was reported by the microscopist of the hospital as malignant adenoma. Six months later, after eight or ten more operations, under other hands, the examinations in another pathological laboratory elicited the report that it was a typical case of adenoma changing into an epithelioma. The patient rapidly grew worse, and died six weeks later, the growth having broken through the wall of the nose and destroyed the left eye in its ravages.

Nasal Fibroma.—Dr. E. Casselberry, of Cincinnati, reports (*Annals of Otology, Rhinology, and Laryngology*, May, 1898) a case operated upon in 1886, in a lady aged thirty-nine years, who has remained free from recurrence for eleven years, without any nasal disease or discomfort whatsoever.

Rhino-pharyngeal Fibroma.—Dr. Hanau W. Loeb, of St. Louis, reports (*Annals of Otology, Rhinology, and Laryngology*, May, 1898) a case of rhino-pharyngeal fibroma, with projections extending to both anterior nares (cystadenoma fibromatosum vasculosum), operated upon by him in 1892. The patient, a female subject, aged thirteen years, has had no recurrence, the nasal respiration being entirely free and unobstructed at the last examination in December, 1897.

Epithelioma of the Tonsil.—Dr. A. F. Jonas, of Omaha, reports (*Journal of the American Medical Association*, 1898, vol. xxxi., No. 7) two successful cases of the removal of an epitheliomatous tonsil by external access. Both were in male subjects. One was last seen nearly four years after the operation, with no traces of recurrence. The second, which was a much more complicated case, improved for three months, when he succumbed to a catarrhal pneumonia, but without any recurrence of the disease in his throat. He had lost power of swallowing solids after the operation, and the tongue had become atrophied upon the same side of the body from which the tonsil was removed, articulation having become somewhat interfered with.

The operative procedures were similar to those practised by Cheever, of Boston, and prophylactic tracheotomy was not found necessary in either instance.

The Tonsils as Places of Entrance for Severe General Infections.—Dr. F. Jessen, Senior Physician in the Vereins Hospital of Hamburg, contributes to the *Münch. med. Woch.*, 1898, No. 23, an article in which he sums up some of the literature, and reports a number of cases showing that tonsils are the places of entrance of infection in many instances attributed to different origin, some of them even without any manifestation of disease upon the surface of the tonsils.

He likewise contends that many and varied cases of so-called scrofula are generally infectious from some portion of the lymphoid ring crossing the roof of the pharynx, and often promptly cured by removal of the diseased tissue.

OTOLOGY.

UNDER THE CHARGE OF

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Acute Mastoiditis.—Extra- and intramastoiditis, three months after measles in a child aged six years, attended with œdema of the face and side of the head, extending to the thin bony plate of the middle fossa, entirely relieved by a mastoid operation by Dr. B. M. Baker, is reported by J. F. Woodward (*New York Medical Journal*, October 9, 1897). [The suggestion to ward off acute mastoiditis in acute otitis media, by syringing sterilized water, or any antiseptic, through the Eustachian tube (Grossard, *Journal of Eye, Ear, and Throat Disease*, October, 1897) we consider irrational and irritative, and therefore promotive of mastoiditis.]

Pus in the Lateral Ventricle.—A remarkable and fatal result of acute otitis media has been observed by A. Levy (*Archiv f. Otol.*, July, 1897) in a man who recovered from the acute ear-disease in a month. Two weeks later he was seized with moderate pain in the previously diseased ear, which lasted for one day, and was succeeded by pain in the abdomen, vomiting, and slight fever. A week later there ensued stupor, vertigo without headache, coma, and death. The autopsy revealed caries of the lower part of the petrous bone and pus in the lateral ventricle. The middle ear was normal, except for the swelling of the mucous membrane.

Otitic Pyæmia.—Two cases of otitic pyæmia resulting from acute otitis media in young subjects, aged twelve and fourteen years, are presented by H. Eulenstein (*Archiv f. Otol.*, April, 1898).

The first case proved suddenly fatal from sinus thrombosis, as discovered at the autopsy. Recovery ensued in the second case after a mastoid operation, exposure of the bony wall of the lateral sinus, and removal of its necrotic portions. Pyæmic temperature continued for a week. The sinus was not opened, but Eulenstein believes that there existed in this instance simply a parietal thrombus from inflammation of the bony wall of the sinus.

Acute Leptomeningitis.—Acute leptomeningitis, following acute purulent otitis media, and proving fatal on the seventh day of the illness, is reported by J. F. WOODWARD (*New York Medical Journal*, October 9, 1897).

Acute Mastoiditis with Extradural Abscess.—HENNEBERT (*Ann. des Mal. de l'Oreille*, January, 1898) reports acute mastoiditis following acute otitis media, productive of an extradural abscess in a man, aged fifty years. Entire recovery ensued upon opening the mastoid and draining the extradural abscess. A noteworthy symptom in this case was the entire absence of fever during the entire course of the disease. Pain and swelling in the mastoid with cerebral symptoms led to the exploration and operation.

Retropharyngeal Abscess. — Retropharyngeal abscess in very young children, from two months to two years old, as a result of suppurative otitis, has been observed by CLOPOTT (*Arch. of Ped.*, November, 1897). The principal symptoms are those of interference with respiration and deglutition. There is often swelling at the angle of the jaw. Clopott advises that the abscess should be incised internally, discharging into the mouth.

[There seems to be some danger of septic pneumonia if pus is permitted to escape into the mouth, and therefore if a retropharyngeal abscess of otitic origin can be evacuated externally near the angle of the jaw it is, in our opinion, a better method.—ED.]

Torticollis.—Torticollis in connection with acute purulent otitis media, relieved quickly by paracentesis and free outlet of pus confined in the drum-cavity, has been observed and reported by R. HAUG (*Archiv f. Ohrenh.*, September, 1867, pp. 17 and 22). Gelle reported some years ago a number of cases of torticollis in children as dependent upon acute inflammation of the ear, and advised in all cases of torticollis in children to inspect the ear.

Facial Paralysis.—Facial paralyses, often lasting for several months, may disappear entirely. Some months later in such cases facial contractility may become augmented, as in two cases recorded by URBANTSCHITSCH (*Austrian Otol. Soc.*, November 30, 1897; *Ann. des Mal. de l'Orielle*, May, 1898). POLITZER (*Austrian Otol. Soc.*, October 26, 1897; *Ann. des Mal. de l'Oreille*, March, 1898) has observed a case of traumatism of the skull, followed by hemorrhage from both ears and bilateral facial paralysis, without marked alteration in the hearing. It is supposed that a fracture of btoh temporal bones occurred, running through the postero-superior walls of both auditory canals and the posterior walls of the tympana, and thus through the Fallopian canal. Politzer expected the facial paralysis to disappear under iodides, iodine inunctions of the mastoids, and galvanization of the nerves of the face.

Facial paralysis of otitic origin may be attended with ascending degeneration, finally affecting the tenth, eleventh, and twelfth nerves by propagation of the process from the facial to these neighboring nerves by means of the bulb, as observed in a drunkard, by G. GERONZI (*Ann. of Otol., Rhin., and Laryn.*, November, 1898).

Middle Ear in Diabetes.—Suppuration of the middle ear and mastoid in the late stages of a fatal case of diabetes mellitus is reported by O. KÖRNER (*Archives of Otol.*, October, 1897). The mastoid involvement was diagnosticated only by the *dulness on percussion* of the affected side, the opposite bone emitting a normal bony resonance on percussion. No operation could be performed on account of the advanced diabetic state of the patient.

Middle Ear in Bright's Disease.—MORF (*Zeitschr. f. Ohrenh.*, Bd. XXX; *Archiv f. Ohrenh.*, December 17, 1897), accepting the statement of Dieulafoy that in nearly half the cases of nephritis ear affections occur, has observed twenty-four cases of nephritic ear disease. In the presence of functional anomalies in the auditory apparatus, without other demonstrative causes the urine should always be examined. If a physical aural lesion is present in a nephritic subject, the ear as well as the kidney must be treated. If there is only a functional disturbance in the ear in nephritis, it will usually disappear under renal treatment.

Middle Ear in Syphilis.—HENNEBERT (*Ann. des Mal. de l'Oreille*, January, 1898) maintains that acquired syphilis of the ear is rare and often unrecognized. Syphilis of the external and middle ear generally yields to specific treatment, but syphilis of the labyrinth, the internal ear, presents an unfavorable prognosis. Hereditary syphilis is often the cause of disease of all parts of the ear, according to BROECKAERT (*Ann. des Mal. de l'Oreille*, January, 1898). There are then symptoms of syphilis in such cases, so that the diagnosis and treatment become clear. In the treatment of syphilis of the ear pilocarpine proves efficient, according to the experience of Broeckaert and others, if applied early in the disease.

HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

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House Quarantine of Yellow Fever.—In an able paper on the "Quarantining of Houses for the Prevention of the Spread of Yellow Fever" PROFESSOR S. E. CHAILLÉ (*New Orleans Medical and Surgical Journal*, May, 1898) vigorously opposes the practice and the claim that the experiment which was tried for the first time in New Orleans in 1897 diminished the number of cases and reduced the number of deaths, and advocates instead the isolation of the sick in hospitals, the removal of those who have been exposed to infection to a camp of detention for five full days, and the thorough cleans-

ing and disinfection of the house and premises. The objections to house quarantine are that it causes great popular dissatisfaction and discourages prompt diagnosis and notification, that the execution of measures successful in hospitals is much less practicable in most houses, that even in the best houses isolation is exceedingly difficult as to attendants and relatives, that in many houses neither proper rooms nor attendants can be provided, and that in the crowded lodging-houses efficient isolation is hopeless. Attendants may be negligent, visitors' clothing may become infected, and thus cause further spread; there is temptation to violate the restrictions and to conceal sickness; inmates escape from the house before and during quarantine, and the well inmates are deprived of necessary occupation.

Treatment of the sick in isolation hospitals, where every precaution of disinfecting all discharges may be observed, and where indiscriminate ingress and egress can be controlled and prevented, is shown to be quite free from the danger of spreading the disease from the sick to the well. In every year when yellow fever has prevailed in New Orleans there have been instances of many non-immunes exposed to the sick in hospitals, asylums, convents, and jails, without one of them being attacked even after weeks of exposure. In 1897 there were at the Touro Infirmary 105 cases with 10 deaths. Twenty non-immune students and nurses constantly in attendance, and about a hundred patients with other diseases, escaped without a single case; but not one of these people was permitted to go out and return and run the risk of becoming infected outside. At the same time, at the Isolation Hospital, 202 cases were admitted, of whom 45 died. Eighteen non-immunes were long exposed to the sick, and more than a hundred workmen were temporarily exposed, and not one of this number was attacked. The preventive measures adopted included prompt and thorough disinfection of all excreta from the sick; thorough cleanliness of the body, the clothing of the sick and of bedding and all personal effects, as well as of the house and premises; free exposure to the sun's rays; and non-intercourse between those inside and those outside the hospital.

The indispensable prerequisites for stamping out any epidemic disease are prompt diagnosis and prompt notification; but in the case of yellow fever the authorities are hampered by the reluctance of the physician to report a mere suspicion of the disease on account of the danger of injury to his practice and of alarming the public and arousing the hostility of those engaged in commerce.

Opposing the claim that, even though the quarantining of houses was admittedly a partial failure, its effect was to keep down the number of cases and of deaths, he calls attention to the fact that no great epidemic has ever resulted when the first cases appeared later than June, and that whenever the first cases have occurred after July there have never before followed as many deaths as the 298 of 1897, in which year the first death occurred in September, and this in the face of the fact that until 1867 no measures were taken to prevent its spread; that until 1879 isolation of the sick was never attempted, and that until 1897 quarantine of both sick and well in houses had never been tried. For fifteen years prior to 1897 New Orleans had been free from the disease, the last cases occurring in 1882, when there were four deaths, and the escape of the city at that time from an epidemic was attrib-

uted by Dr. Joseph Jones, the President of the State Board, to isolation of the sick and thorough cleansing and disinfection of the section surrounding the focus of infection for at least four blocks each way.

Dr. Chaille quotes approvingly from Dr. Kohnke's report, which recommends that, instead of quarantining in a house with the sick all of the inmates who are well, the bread-winners should be permitted to come and go under strict precautions as to disinfection, care of clothing, and place of sleeping. Not of the least importance is the dissemination of sanitary knowledge among the people, especially a knowledge of the infective nature of the disease, its disastrous results to the public, the preventive measures indispensable for its extinction, and the necessity for serious restrictions on the sick-room and for some restrictions on the well inmates of the house.

Meat Poisoning.—A new organism connected with the production of poisonous effects due to the ingestion of diseased meat has been discovered by Dr. G. Wesenberg (*Zeitschrift für Hygiene und Infectionskrankheiten*, September 23, 1898, p. 484), who investigated an outbreak at Mansfeld, in which sixty-three persons became ill after eating the meat of a cow which had been killed in consequence of a diagnosis of traumatic pericarditis. Only those who ate of the minced meat in a raw state or of the partly cooked liver were affected; those who ate of the well-cooked meat escaped without exception. The symptoms were vomiting and diarrhœa, violent headache and abdominal pain, general muscular weakness, dizziness, and lassitude. The discharges were sometimes greenish, sometimes brownish, and always extremely offensive. With few exceptions the symptoms abated in from three to five days, and all recovered except one, and that a doubtful case in a child who was not known with certainty to have partaken, and whose symptoms might have been due to other causes.

The unconsumed meat when received for examination was already fairly well advanced in decomposition and partly maggoty. All except one piece, which was faintly acid to litmus paper, was alkaline in reaction. Cultures on agar and in bouillon were made from a piece taken from a part which was apparently not yet in process of decomposition. Inoculation of the bouillon cultures and of small bits of the meat into white mice produced fatal results, in some cases from eighteen to twenty-eight hours and in others within three days. A guinea-pig which received a subcutaneous injection of the bouillon culture of the crushed meat died in forty-eight hours, having shown marked lassitude and profuse diarrhœa. Section showed in all cases enlargement of the spleen, which was bluish-red in color, strong injection of the small intestine, and marked redness of the medullary substance of the kidneys. Cover-glass preparations from the spleen showed fairly long and broad bacilli, and the same organisms were developed on agar from the meat itself. The characteristics of the bacilli as to growth, development, staining, etc., are given in detail. The organism proves to be quite different from any hitherto described by Van Ermengem and others who have investigated similar outbreaks. No examinations of the vomitus or stools were made, because all the persons affected had recovered before the investigation was begun. That the outbreak was due to an infection rather than to an intoxication was shown by the facts, first, that those who ate of the meat in a well-

cooked condition escaped; and, second, that mice withstood injections of 1 cm of heated bouillon culture, but were killed by 0.2 c.cm. of the culture when it was not so treated.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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On the Hæmocytoza of Birds.—OPIE (*Journal of Experimental Medicine*, January, 1898) examined 125 birds. The majority of them were obtained from places notoriously malarial; 80 of these were English sparrows, and 12 red-winged blackbirds; the others belonged to a variety of species. Fifteen of these birds showed intra-corpuscular parasites in varying abundance.

He distinguishes two varieties which correspond to those described by Grassi and Felletti. The morphology of the full-grown organism is characteristic of each group. In one an irregularly shaped body containing pigment granules occupies one end of the red corpuscle, while the nucleus is displaced from its normal central position into the opposite end. The other group is characterized by the fact that the full-grown parasite is an elongated pigmented body lying along one side of the nucleus and curving more or less over its two extremities. This is the Halteridium of Labbe. Both develop from very small non-pigmented spherical bodies. In three birds these two varieties were present at the same time. The first or irregular parasite, the Proteosoma of Labbe, is represented in its earliest phase by a rounded clear body within the red corpuscle. As the parasite grows it acquires pigment, which is collected into a more or less loose clump situated near the periphery. This collection of pigment into a single clump is characteristic of the proteosoma. Amœboid movements were not seen, but they probably occur. Not infrequently two parasites were present in the same corpuscle. As the parasite increases in size the nucleus is deflected, and not infrequently lies at right angles to the long axis. This is not due to the pressure exerted on the nucleus by the organism.

Parasites may be seen surrounded by the rim of a red blood-corpuscle from which the nucleus has been extruded. The process of segmentation is very similar to that found in the malarial parasite in man. The parasite first forms a rosette, and the segments of this become free. In fresh specimens of blood slight clumps of pigment surrounded by groups of small spherical bodies may be seen free in the plasma. The segmenting bodies correspond in size with the larger full-grown organisms. They did not seem to undergo a cyclic development in groups as is the case in malaria, but in the same specimen of blood may be found representatives of all stages. Flagellate bodies resembling those seen in human malaria were met with a number of times. The flagella were similar in appearance to those which occur in the

malarial parasites in man. The second variety of parasite, the Halteridium of Labbe, is very different from the irregular form just described. This form was found in the English sparrow, the song sparrow, and the crow. The youngest closely resemble corresponding forms of the irregular parasite. Amœboid movements were not observed. When the corpuscle reaches a certain size it extends around and hugs the nucleus. The large parasites take a deep stain which is not homogeneous, but which is due to small chromatophilic granules. Beside the forms which stain deeply there are other forms which are almost unstained. He does not think that reproduction of this elongated form takes place in the circulating blood, although Labbe has described it. The process of flagellation is easily seen in the Halteridium. Certain of the full-grown bodies which lie in a curved form alongside of the nucleus are seen to collect themselves into an oval, then into a circular form, causing a protrusion from that side of the corpuscle containing it. Then the corpuscle fades away and the round organism is left free. From this the flagella rapidly develop. The liberation of the parasite appears to be the consequence of the changes that take place in the blood as the result of the abnormal conditions produced in making the specimens. Not all the free organisms develop flagella.

He observed certain differences in the Halteridium which suggest the possibility of the existence of different species.

Upon the Existence of a Minute Micro-organism Associated with Cases of Progressive Portal Cirrhosis.—J. G. ADAMI (*Montreal Medical Journal*, 1898) first calls attention to the Pictou cattle disease in which there is a peculiar extensive cirrhosis of the liver, accompanied by swelling of the periportal and retroperitoneal lymph-glands, with some ascites and multiple follicular ulceration of the true stomach. Micro-organisms which are very difficult to stain are found in the tissues. In one case of atrophic portal cirrhosis in man he obtained from the liver by culture an extremely minute diplococcus which stained with great difficulty. In the same case he found micro-organisms in considerable quantities in the tissues. These were of the same general character as those which he had previously seen in the Pictou cattle disease, but were much smaller. The same organisms were also found in the abdominal lymph-glands. In order to demonstrate the organisms sections of the tissues are first placed in weak acetic acid, then in absolute alcohol, and stained in a solution of methylene-blue and aniline oil. Bacteria are found both in the newly formed connective tissue and in the liver cells. He has found these organisms in a number of cases of portal cirrhosis obtained from different sources.

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